Single Aisle
TECHNICAL TRAINING MANUAL
T1+T2 (IAE V2500) (Lvl 2&3)
HYDRAULIC POWER

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HYDRAULIC POWER

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UGB13131 - U7ST0M0

HYDRAULIC POWER SYSTEM COMPONENT LOCATION (2)

SYSTEM OVERVIEW

On the green system the normal source of pressure is the Engine Driven Pump (EDP) and as auxiliary source the Power Transfer Unit (PTU).
On the blue system the normal source of pressure is the electrical pump (E-Pump) and as auxiliary source the Ram Air Turbine (RAT).

NOTE: The blue electric pump can be used as an auxiliary power source for maintenance purposes on ground.

On the yellow system the normal source of pressure is the EDP and as auxiliary sources the PTU and the electric pump (E- Pump).

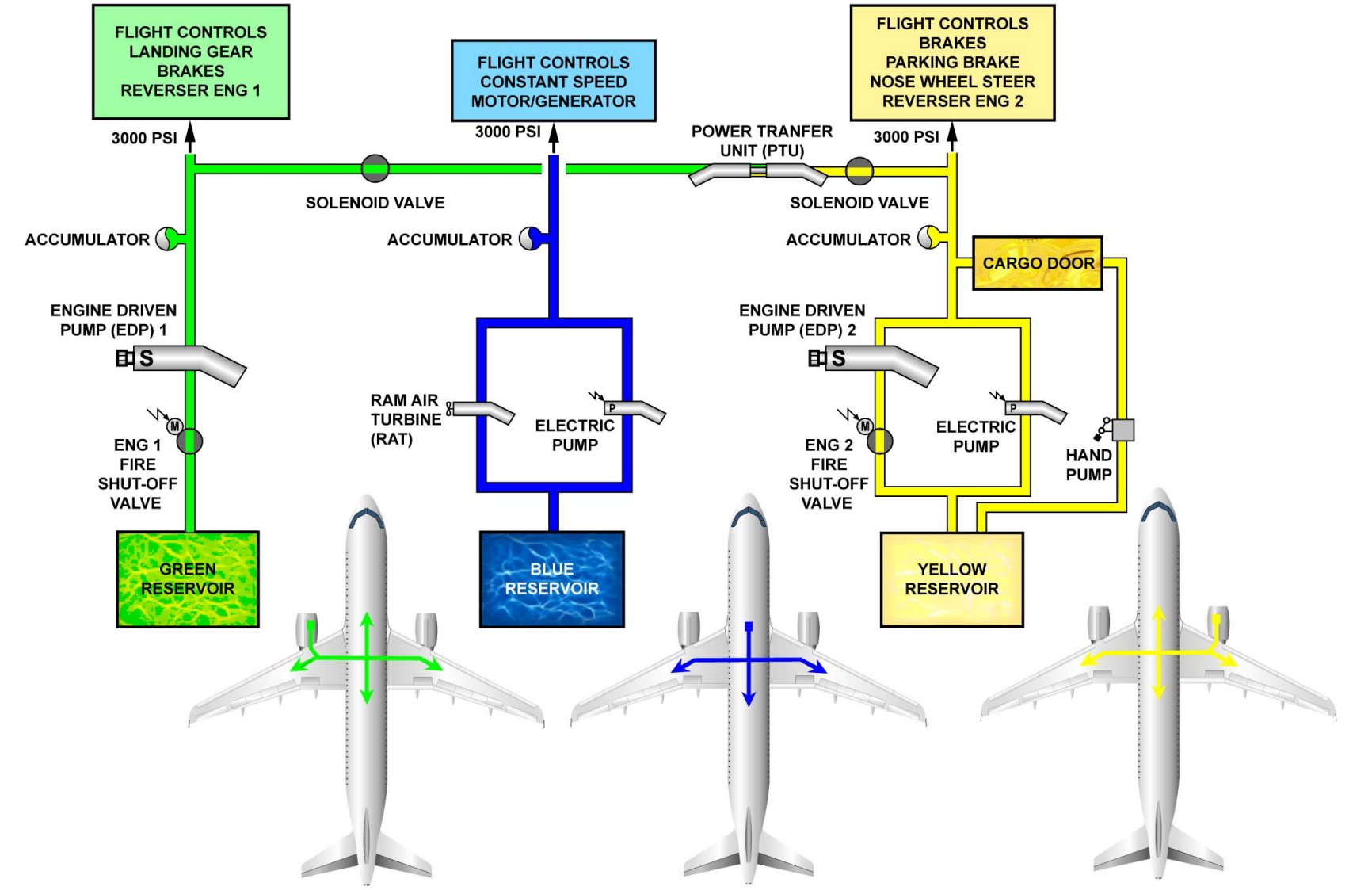
NOTE: The yellow system also has a hand pump dedicated to cargo door operation.

PTU

The PTU is an auxiliary pressure supply for either the green or yellow systems without transfer of fluid between the two systems.
It operates automatically if there is a delta pressure of 500psi between the green / yellow or yellow / green hydraulic systems.
The side operating as a pump will take fluid from its associated reservoir and provide an output through the PTU manifold to the HP manifold.
The motor side is supplied from the HP manifold through the PTU manifold, and is connected to the return system. The PTU is de-activated by closing the solenoid valves on the PTU manifolds.
Each section of the PTU has a case drain connection to the return system.

RAT

The RAT is an auxiliary pressure supply for the blue system, and for the emergency electrical power Constant Speed Motor/Generator (CSM / G). It can be deployed automatically or manually depending on the failure conditions. The RAT is locked when extended.
An interlock mechanism will only permit RAT stowage if the blades are properly aligned.
It also prevents rotation when stowed. The interlock will release at approximately 5 degrees from the full extension position.
Extension is by spring force. Retraction (stowage) is by blue hydraulic pressure.
Up lock release is by solenoid operation.
Down lock release is by hydraulic pressure.



SYSTEM OVERVIEW - PTU & RAT

HYDRAULIC POWER SYSTEM COMPONENT LOCATION (2)

COMPONENT LOCATION

PTU/ELEC PUMPS/RAT

The PTU is located in the main landing gear bay. The blue electric pump and the RAT are located in the blue hydraulic bay and the yellow electric pump is located in the yellow hydraulic bay.

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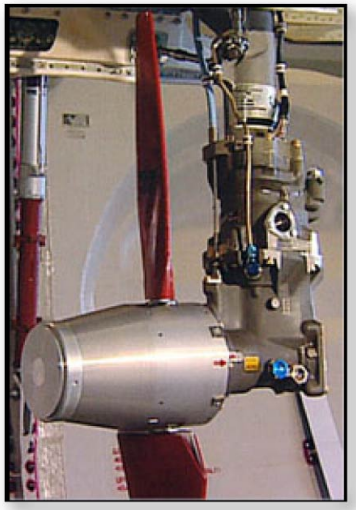
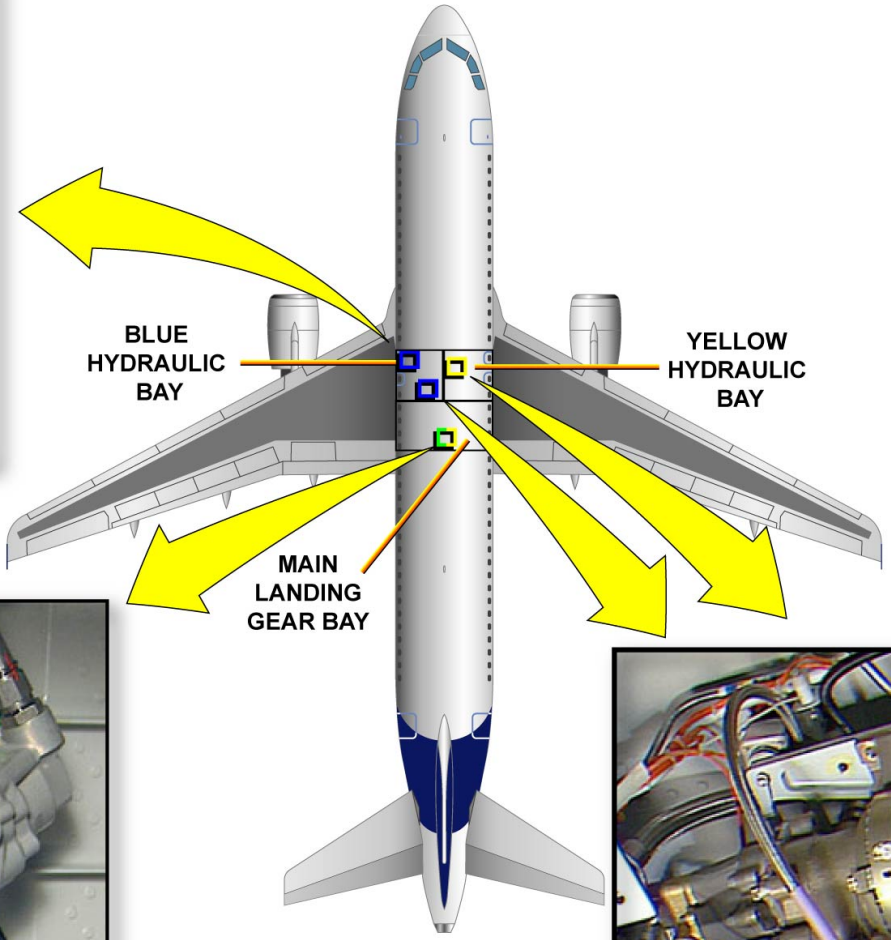
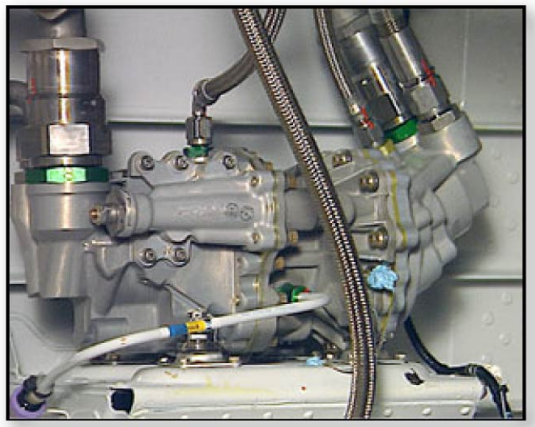
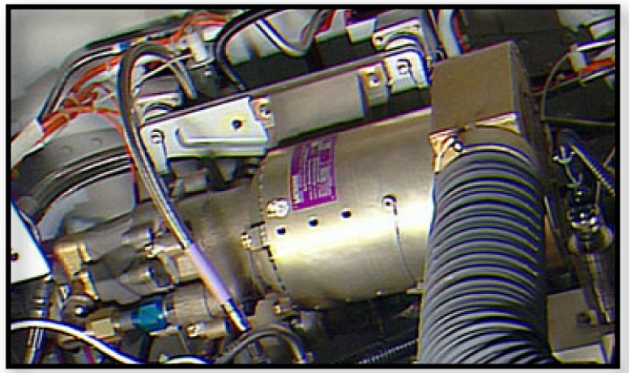


RAM AIR TURBINE (RAT)





POWER TRANSFER UNIT (PTU)



ELECTRIC PUMP

COMPONENT LOCATION - PTU/ELEC PUMPS/RAT

HYDRAULIC POWER SYSTEM COMPONENT LOCATION (2)

COMPONENT LOCATION (continued)

ENGINE PUMP

The EDPs 1 and 2 are located on the accessory gearbox of engine 1 (EDP 1 green system) and engine 2 (EDP 2 yellow system).

RESERVOIR

The green reservoir is located inside the main landing gear bay. The blue reservoir is located aft of the main landing gear bay on the LH side. The yellow reservoir is located inside the yellow hydraulic bay.

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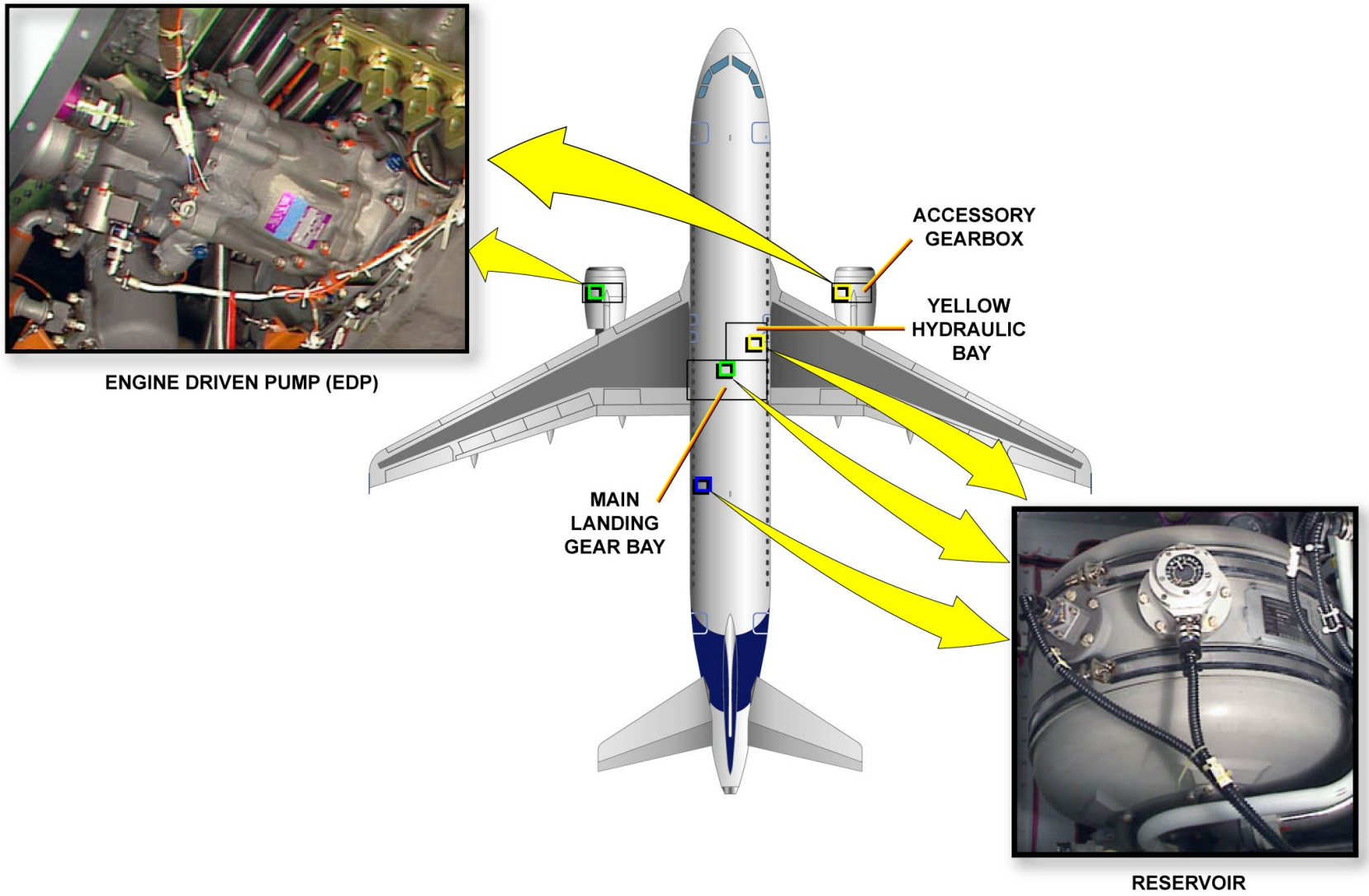


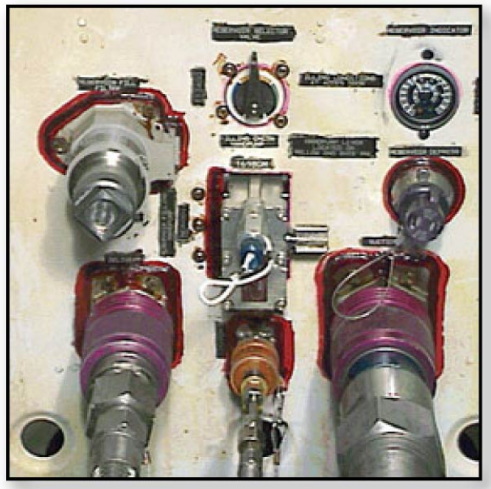
COMPONENT LOCATION - ENGINE PUMP & RESERVOIR

HYDRAULIC POWER SYSTEM COMPONENT LOCATION (2)

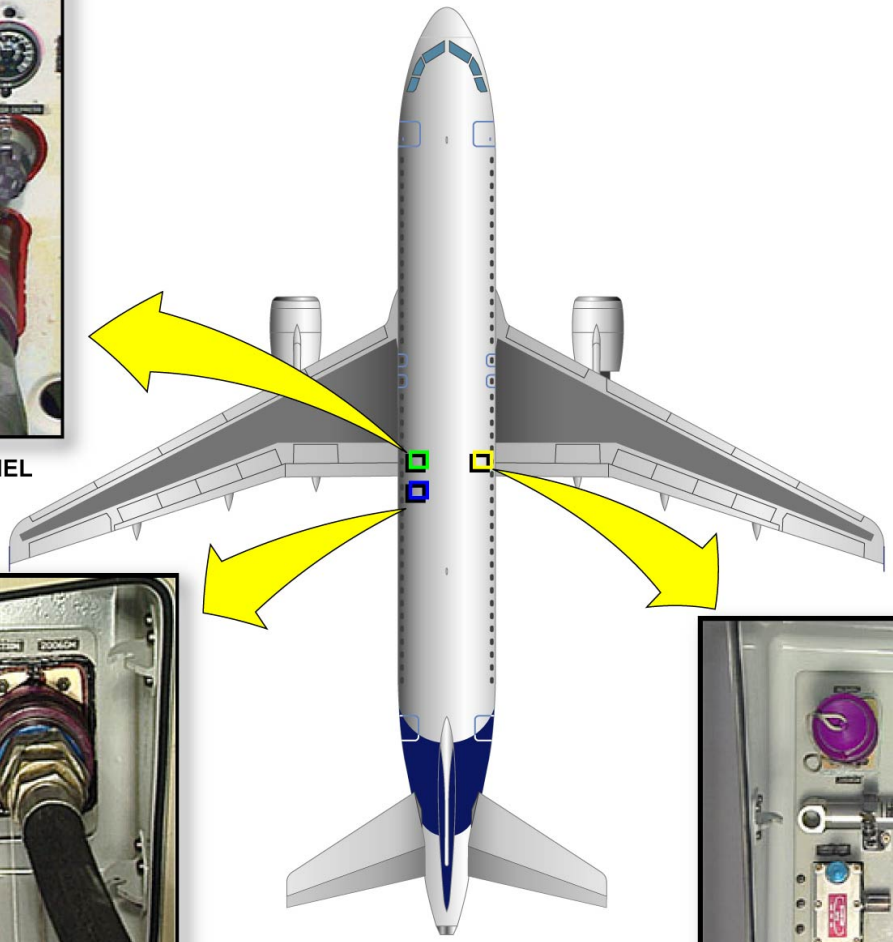
COMPONENT LOCATION (continued)

SERVICING PANELS

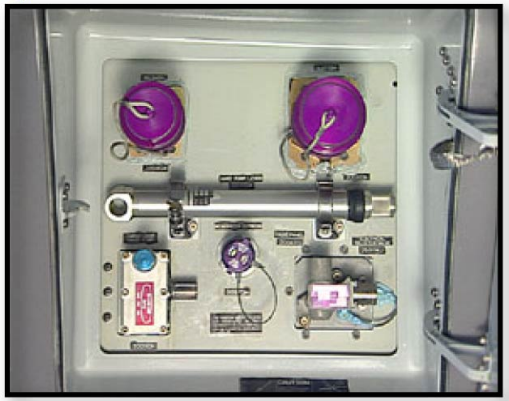
The hydraulic servicing panels are located aft of the main landing gear bay; the green and the blue panels on the LH side, and the yellow panel on the RH side.



GREEN HYDRAULIC SERVICE PANEL



BLUE HYDRAULIC SERVICE PANEL



YELLOW HYDRAULIC SERVICE PANEL

COMPONENT LOCATION - SERVICING PANELS

HYDRAULIC POWER SYSTEM CONTROL & INDICATING (2)

LOCATE CONTROL/INDICATING IN COCKPIT

HYDRAULIC CONTROL/INDICATING

RESERVOIR LOW AIR PRESSURE FAILURE

RESERVOIR FLUID BELOW NORMAL

RESERVOIR FLUID QUANTITY LOW

YELLOW ELECTRICAL PUMP FAILURE

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HYDRAULIC SYSTEM USERS (2)

GREEN, BLUE, YELLOW USERS

The three independent hydraulic systems respectively supply the users indicated on the diagram. Between these systems, the users are shared in order to ensure the aircraft control, even if only one hydraulic system is inoperative. On the blue hydraulic system, the Constant Speed Motor/Generator (CSM/G) is used to provide aircraft electrical power in case of emergency.

PRIORITY VALVES

In the event of low hydraulic pressure, the priority valves maintain the operation of essential systems by cutting off hydraulic power to heavy load users.

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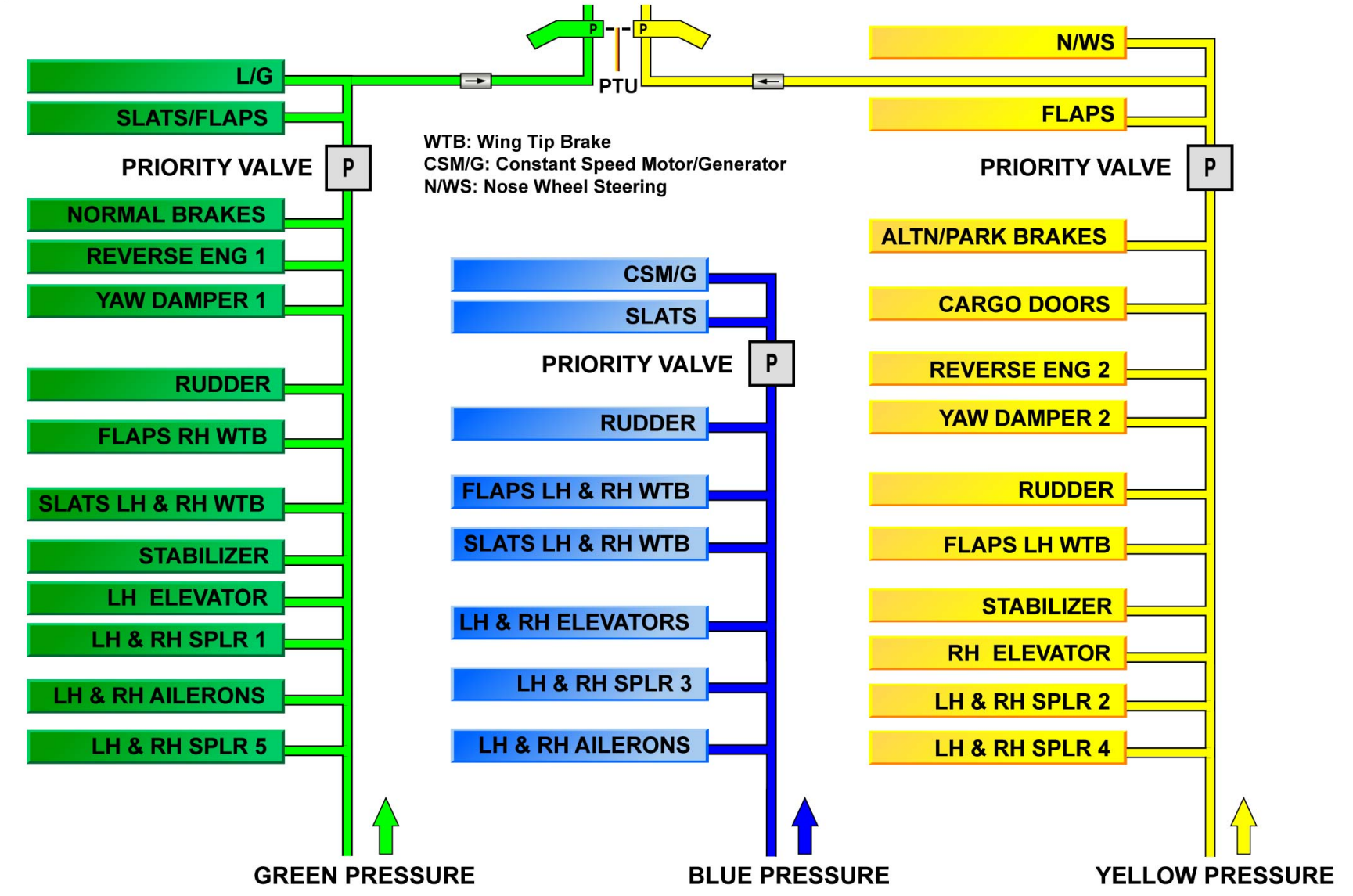

GREEN, BLUE, YELLOW USERS & PRIORITY VALVES

CIRCUIT IDENTIFICATION AND ROUTING (2)

PIPE ROUTING

The A/C has three hydraulically independent systems: blue, green, yellow.
There are no hydraulic pipes in the passenger cabin or flight compartment.

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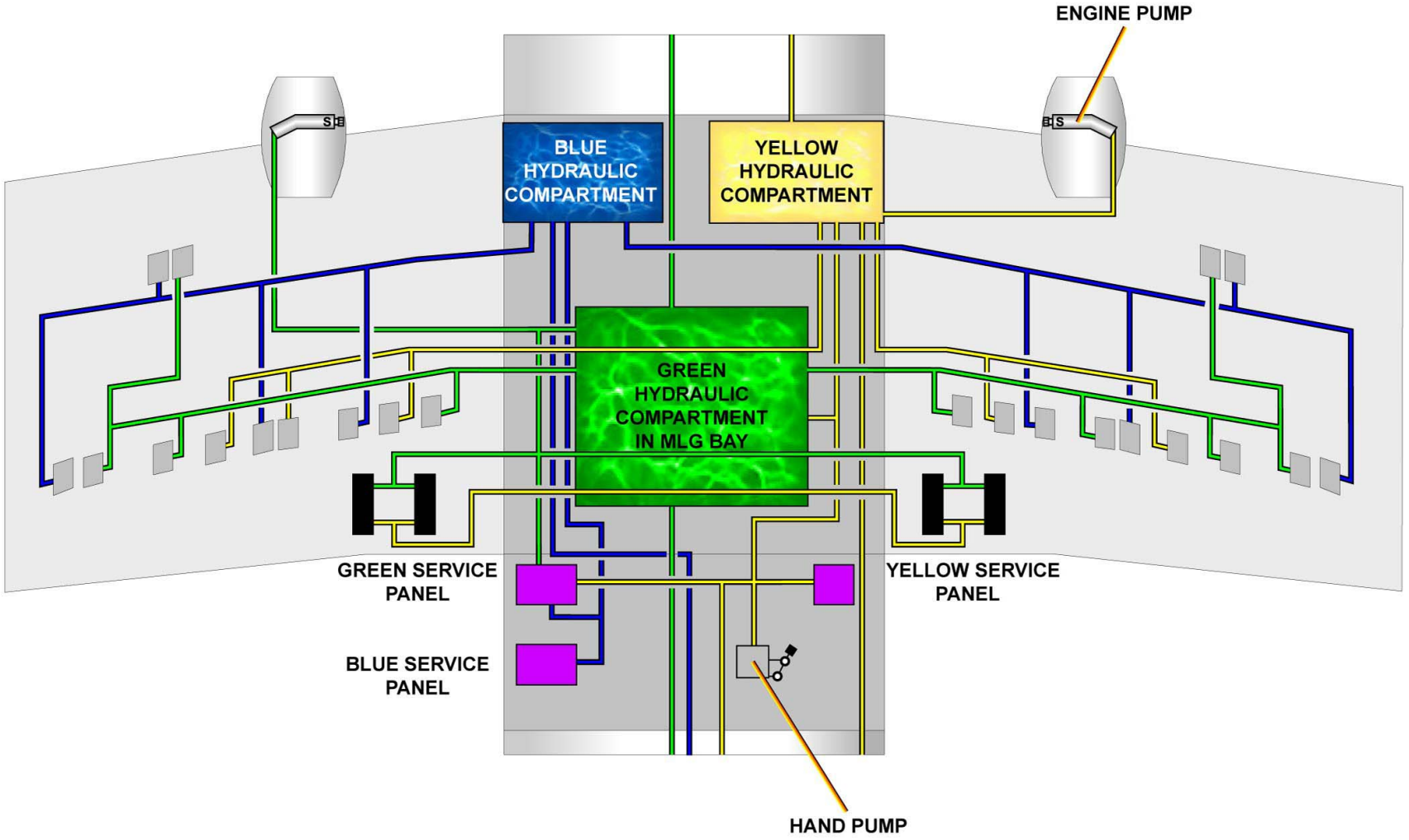

PIPE ROUTING

CIRCUIT IDENTIFICATION AND ROUTING (2)

pipe identification

Each pipe is identified by a self-adhesive label, which indicates:
- the part number of the pipe,
- the identification of the pipe as a hydraulic pipe, its function with black dots and the direction of the fluid flow with yellow and blue fields,
- an identification of the system comprising a color code and a number 1, 2 or 3 respectively indicating the Green, Blue, or Yellow system.

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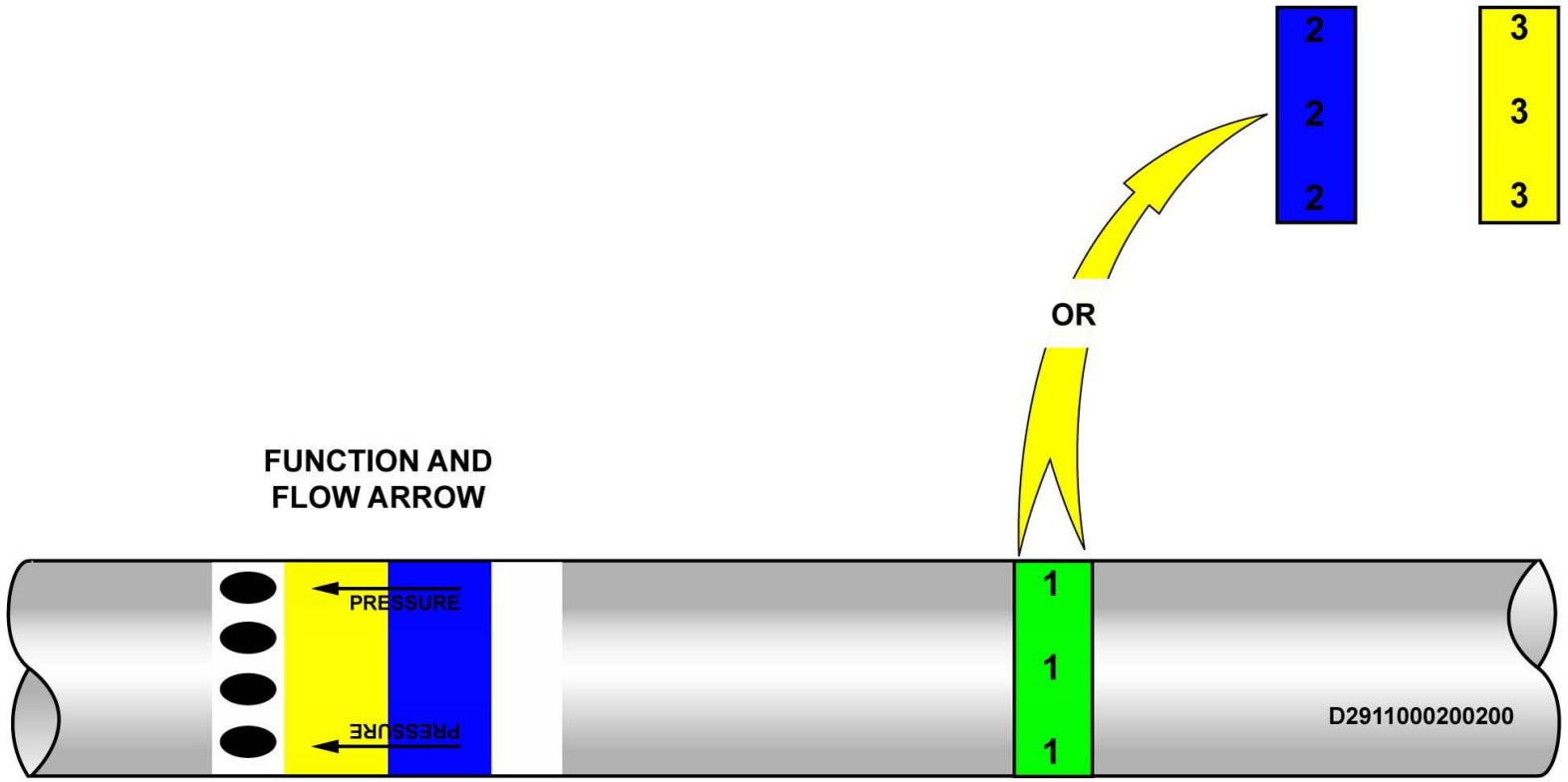

PIPE IDENTIFICATION

CIRCUIT IDENTIFICATION AND ROUTING (2)

component identification

Each hydraulic component is identified by a placard affixed on the structure near to it, which gives its Functional Item Number (FIN) and its designation.

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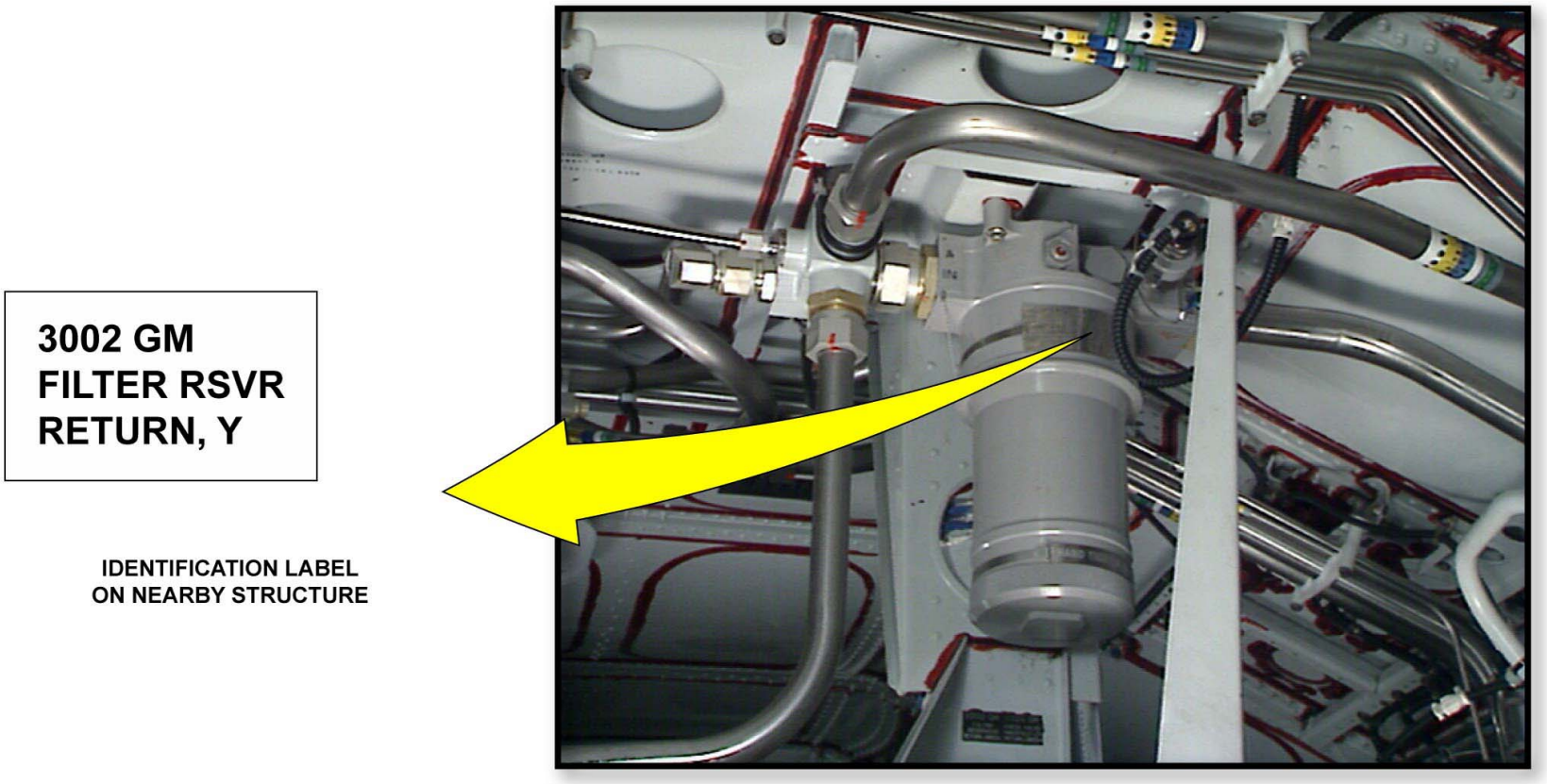


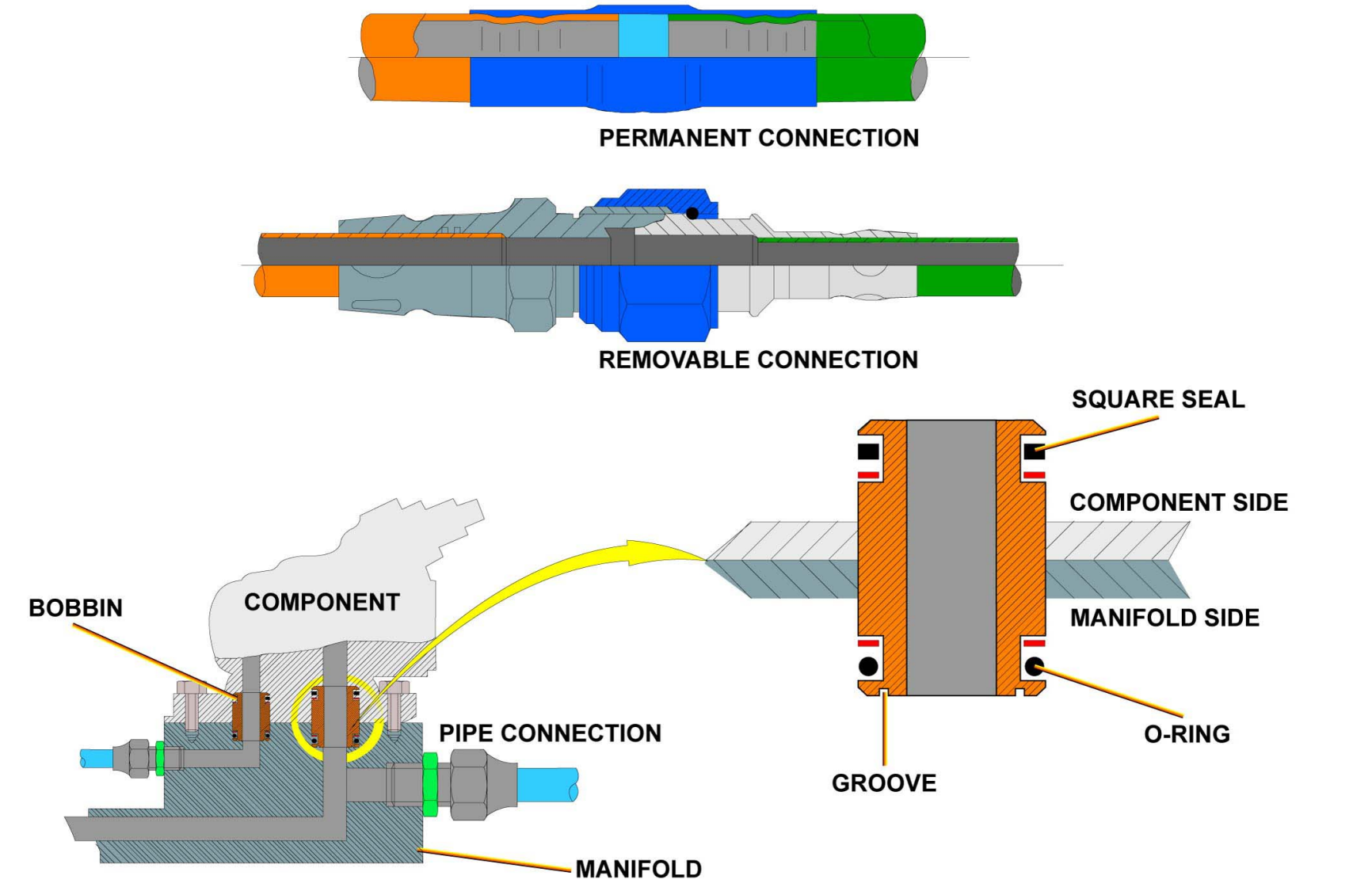
COMPONENT IDENTIFICATION

CIRCUIT IDENTIFICATION AND ROUTING (2)

cONNECTIONS

The most common connections in the hydraulic system are shown below.
There are two types of connections:
- permanent connections or permaswage,
- removable connections or standard straight or special fittings.

The manifolds have bobbin type connections for some components. The bobbins are equipped with a square seal on the component side and an O-ring on the manifold side.



CONNECTIONS

GREEN HYDRAULIC SYSTEM D/O (3)

B2 SCOPE

CAUTION: MODULE TAGGED B2 SCOPE.
BE AWARE THAT ONLY AVIONICS/ELECTRICAL TOPICS SHOULD BE LEARNED FOR A T2 COURSE.

GENERAL

Most of the system components are installed in the MLG compartment.

RESERVOIR

The reservoir has a direct reading gauge, a quantity indicator and a low level switch for ECAM indicating and warning.
There are three levels:
- Normal fill level: 14 l. (3.7 US gal),
- Maximum gaugeable level: 18 l. (4.76 US gal),
- Low level warning: 3.0 ± 0.4 l. (0.79 ± 0.1 US gal).

RESERVOIR PRESSURIZATION

The reservoir is normally pressurized with air to prevent cavitation of the pumps. The reservoir is pressurized to 50 psi (3.45 bar) and is sealed to hold the pressure when there is no air supply. The threshold of the LP switch is 22 psi (1.52 bar). The threshold of the pressure relief valve is 77 psi (5.3 bar).

FIRE VALVE

The green system fire valve installed in the LH wing, inboard of the pylon, is controlled by ENG 1 FIRE P/B. When the valve closes, it stops the supply of fluid to the Engine Driven Pump (EDP).

EDP

The EDP is attached to the accessory gearbox. A solenoid valve controlled by the ENG 1 PUMP P/B selects the pressurized or depressurized mode. The EDP cooling and lubricating flow goes through the case drain filter installed in the return circuit. Pump outlet pressure is 3000 psi (206 bar) at zero flow. The EDP includes a blocking valve, which isolates the pump from the hydraulic system when the pump operates in depressurized mode. Case drain filter clogging indication: P = 87 ± 8.7 psi (6 ± 0.6 bar).

ACOUSTIC FILTER

The acoustic filter is installed in the outlet from the green EDP. It removes the pulses of pressure of the HP flow from the pump. The acoustic filter is an empty metal sphere, with inlet and outlet connections on opposite sides.

PRESSURE SWITCH

The EDP pressure switch monitors the EDP outlet pressure for ECAM indications. The threshold of the pressure switch is 1740 psi (120 bar).

NOTE: A check valve downstream of the pump stops the fluid flow to the pump if the system is pressurized by the PTU.

GROUND COUPLINGS

The ground service panel has two connectors used to pressurize the green hydraulic system from a ground cart. A selector valve, two connectors and a hand pump are used for hydraulic reservoir refilling.

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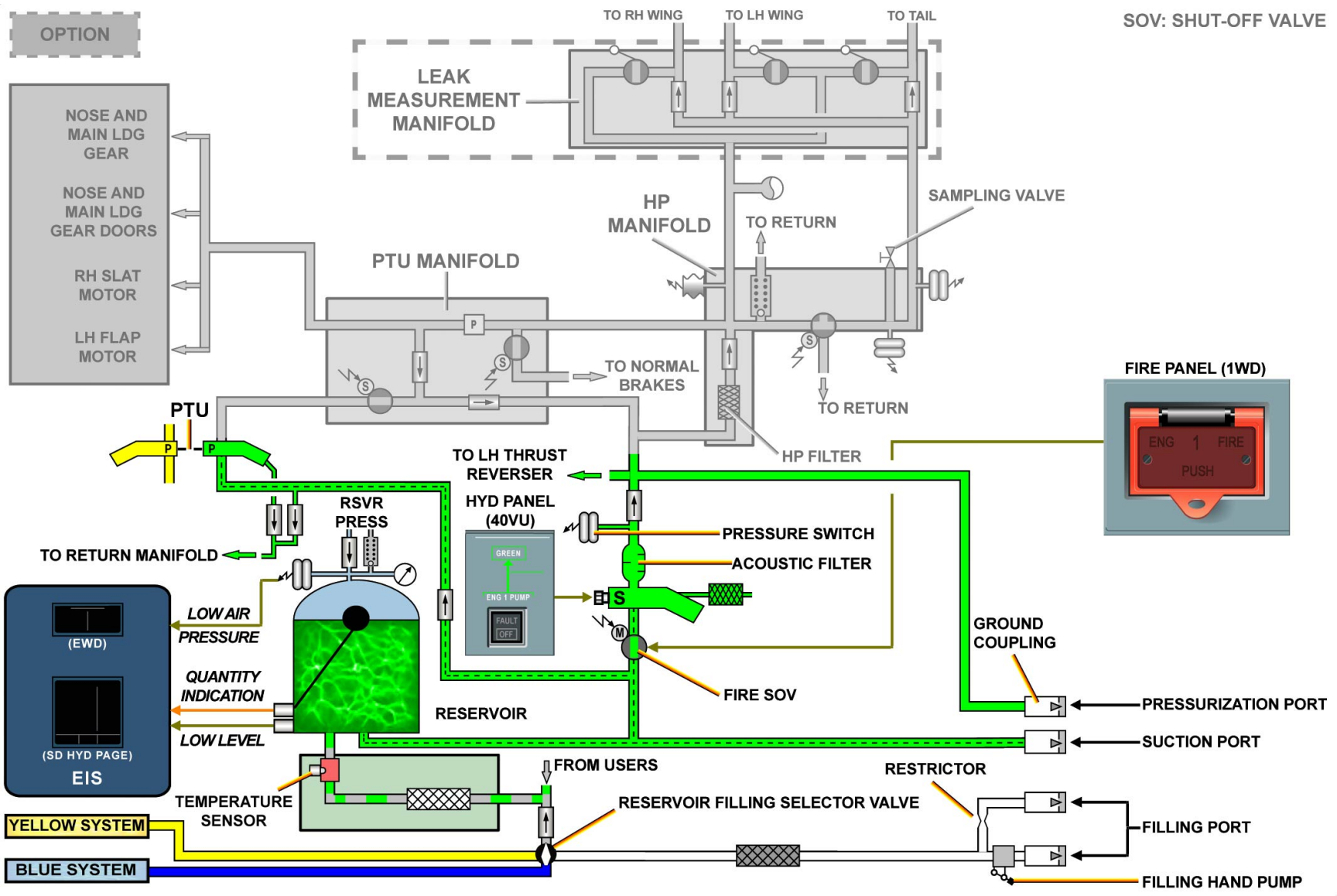

B2 SCOPE ... GROUND COUPLINGS

GREEN HYDRAULIC SYSTEM D/O (3)

HP MANIFOLD

The High Pressure (HP) manifold supplies the PTU manifold and the leak measurement manifold.

PRESSURE SWITCHES

The signals from both pressure switches at the HP manifold are sent to the Flight Control Computers (FCCs), to the Braking/Steering Control Unit (BSCU), the ECAM will receive information from one of the two switches for LP indication, and to the Flight Augmentation Computer (FAC). The threshold of the pressure switches is 1450 psi (99.5 bar).

PRESSURE TRANSDUCER

The pressure transducer provides data for pressure indication on the ECAM and sends information to Elevator Aileron Computers (ELACs) 1 and 2.

LEAK MEASUREMENT VALVE

The leak measurement valve isolates the primary flight controls when the guarded LEAK MEASUREMENT VALVES P/B on the maintenance panel is set to OFF.

HP FILTER

The HP filter has a clogging indicator. The clogging indicator operates when the differential pressure is higher than 87 ± 8.7 psi (6 ± 0.6 bar).

ACCUMULATOR

The accumulator acts as a damper for small changes. It also makes a supply of fluid available in case of any demand. The accumulator is precharged with nitrogen to 1885 psi (130 bar) at 20°C. It holds 1.1l (0.29 US gal) of total volume of fluid when it is full.

SAMPLING VALVE

A sampling valve is provided on the HP manifold.

NOTE: CAUTION: when sampling, let the fluid run for a moment into a container, then put 0.2L (0.05USG) of fluid into an appropriate bottle for analysis.

PRESSURE RELIEF VALVE

The system relief valve connects the HP circuit to the return circuit in case of overpressure. The relief valve opens at 3436 psi (237 bar) and closes at 3190 psi (220 bar).

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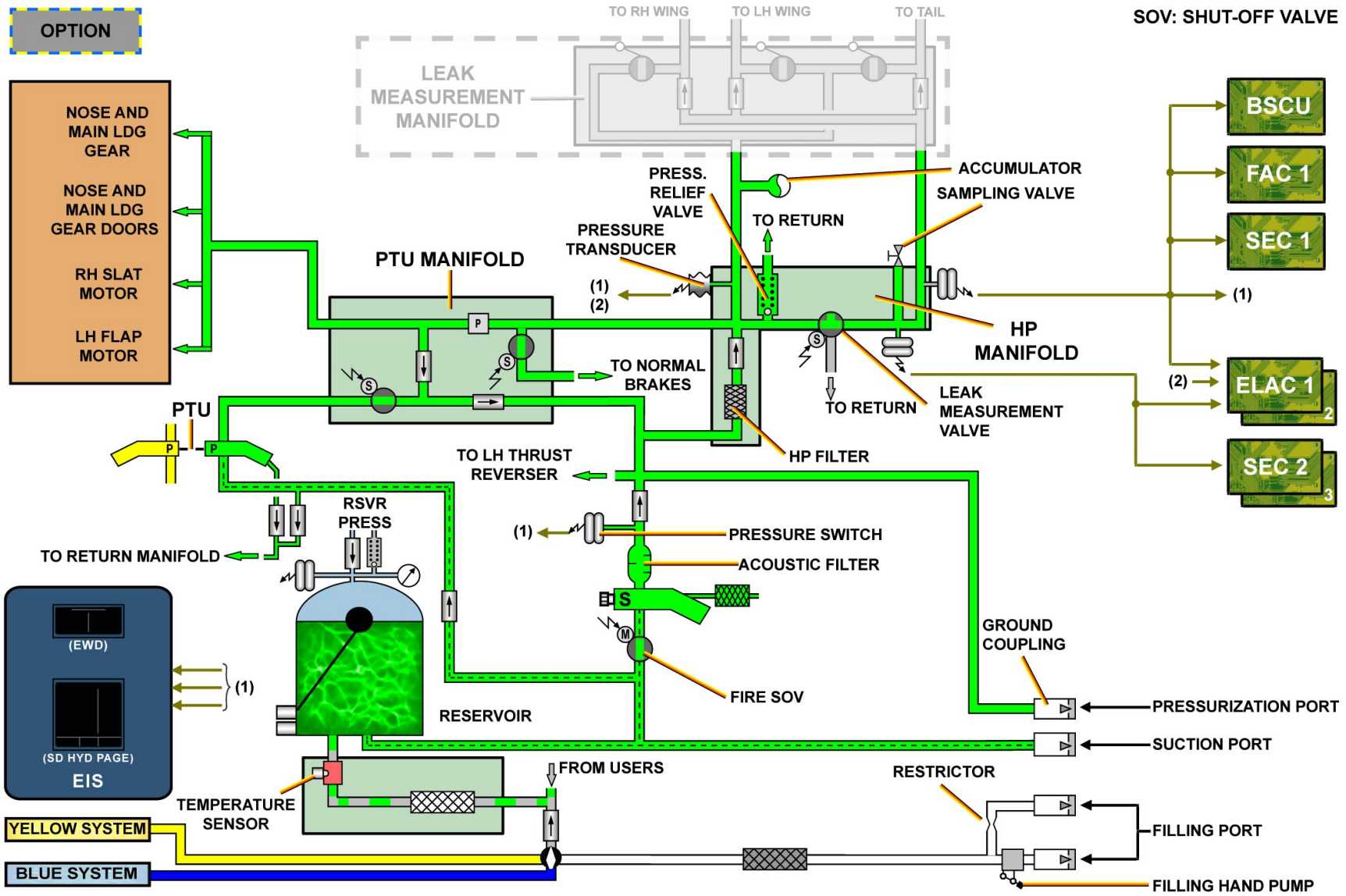

HP MANIFOLD - PRESSURE SWITCHES ... PRESSURE RELIEF VALVE

GREEN HYDRAULIC SYSTEM D/O (3)

LEAK MEASUREMENT MANIFOLD (OPTIONAL)

The optional leak measurement manifold supplies the flight controls of the RH wing, LH wing and tail section via three outputs. After closing the related leak measurement valve, operating manually a spool valve lets the related section be supplied for leak measurement testing.

PTU MANIFOLD

The PTU manifold is composed of three different valves:
- The normal braking selector valve which cuts the hydraulic supply to the normal brakes,
- The solenoid valve installed in the PTU supply line which stops the PTU operation,
- The priority valve which makes sure that all available hydraulic pressure is sent to the primary flight controls if pressure in the system is reduced.

RETURN MANIFOLD

The return manifold comprises:
- One return filter with a clogging indicator and a by-pass device,
- One temperature sensor which has one temperature switch and two temperature transducers.

The red pin of clogging indicator comes out when the differential pressure across the filter is more than 29 ± 4.4 psi (2 ± 0.3 bar).
The by-pass operates when the differential pressure across the filter is more than 58 ± 6.0 psi (4.0 ± 0.4 bar). Then the device lets the fluid go from inlet to outlet without filtration. The temperature switch and temperature transducers send data for ECAM warnings and indication on overhead P/Bs.

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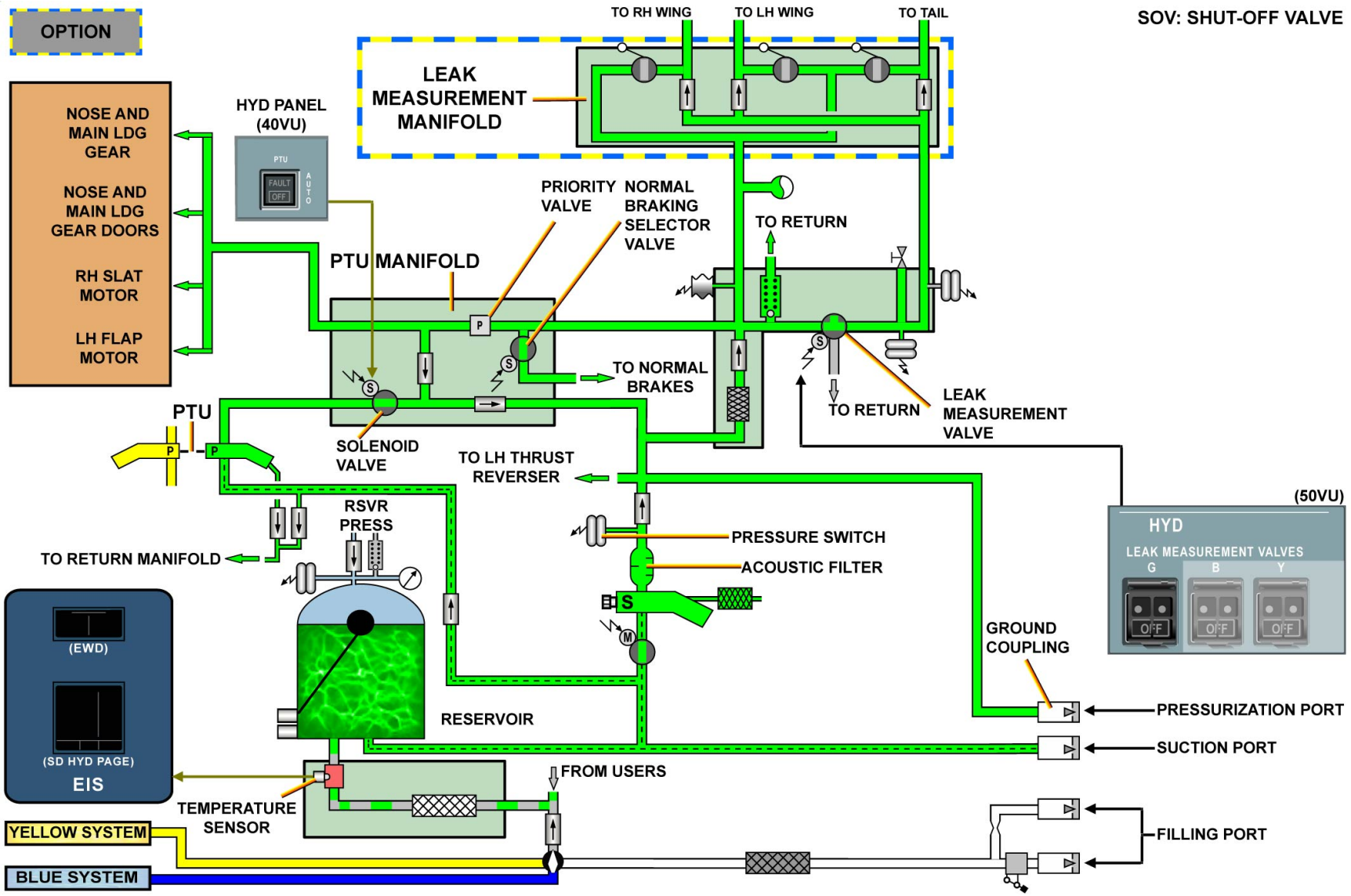

LEAK MEASUREMENT MANIFOLD (OPTIONAL) ... RETURN MANIFOLD

GREEN HYDRAULIC SYSTEM D/O (3)

POWER TRANSFER UNIT (PTU)

PTU NORMAL OPERATION (NOT INHIBITED)

The Power Transfer Unit (PTU) will run automatically when the differential pressure between the green and yellow circuits is greater than 500 psi (34.5 bar).

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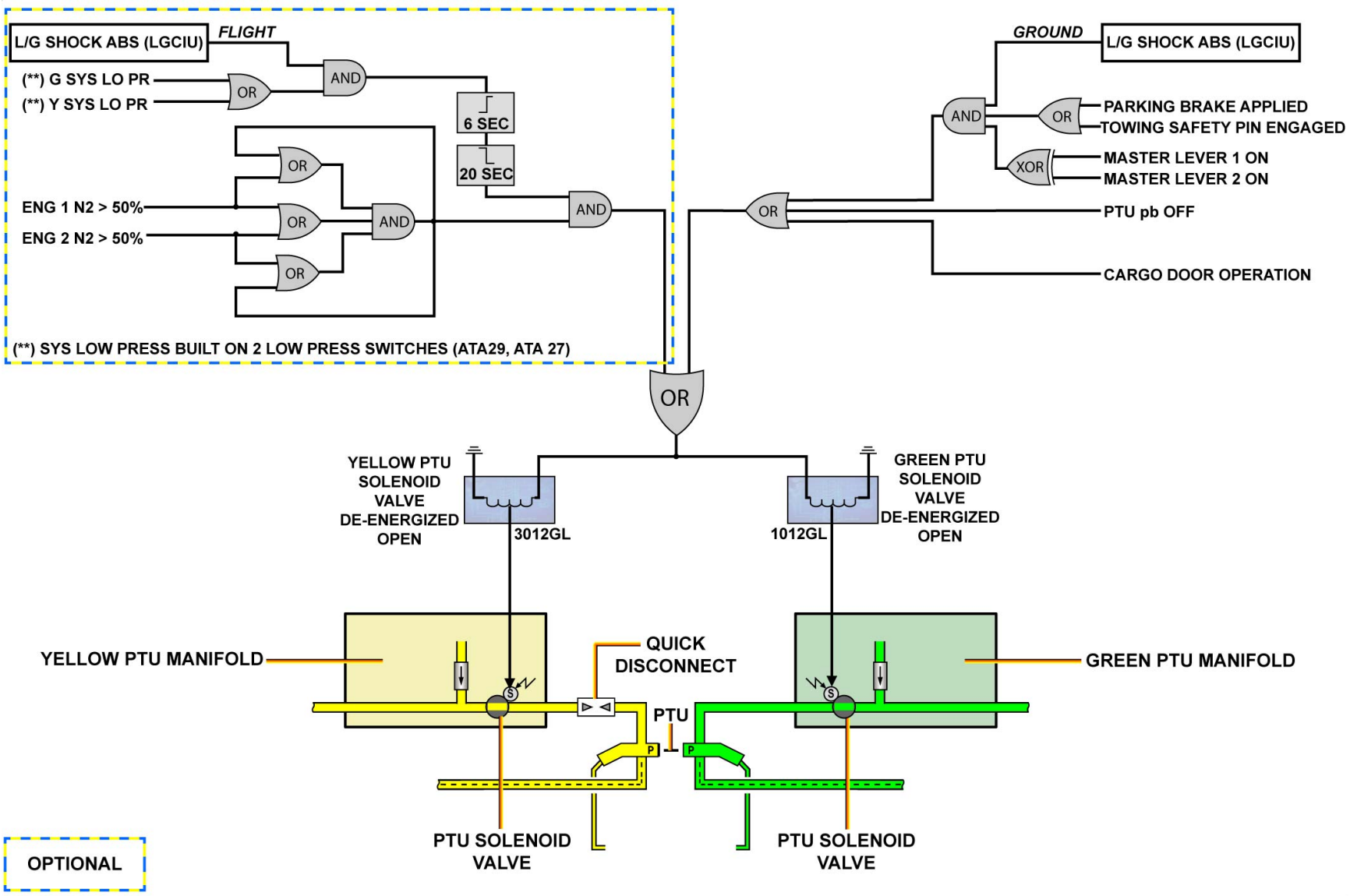

POWER TRANSFER UNIT (PTU) - PTU NORMAL OPERATION (NOT INHIBITED)

GREEN HYDRAULIC SYSTEM D/O (3)

POWER TRANSFER UNIT (PTU) (continued)

PTU INHIBITED

The PTU operation is inhibited:
- During cargo door operation,
- If the PTU P/B is switched OFF,
- When the A/C is on ground, with one engine running and if the parking brake is set on or the nose wheel steering is disconnected for towing (example: First engine start up during push back).

As an option, a PTU inhibition logic prevents the PTU from running in overspeed condition (Hyd reservoir low level on one sys) and later on leads to the loss of the second sys (Hyd reservoir overheat on the other sys). In flight, if the PTU is not able to pressurize a hydraulic failed system (G SYS LO PR or Y SYS LO PR) within 6 seconds, either due to external leakage or PTU failure, the PTU is automatically inhibited. This PTU inhibition logic is activated if both engines are running and remains activated as long as one engine is running.

The 20s relay has been installed for the deactivation of the PTU inhibition logic. Once the PTU has been automatically inhibited, the logic is "de-latched" and PTU no longer inhibited 20 seconds after one of the following are met:
- A/C on ground OR,
- Both engines stopped,
- The affected hydraulic system does not longer detect a low-pressure condition.

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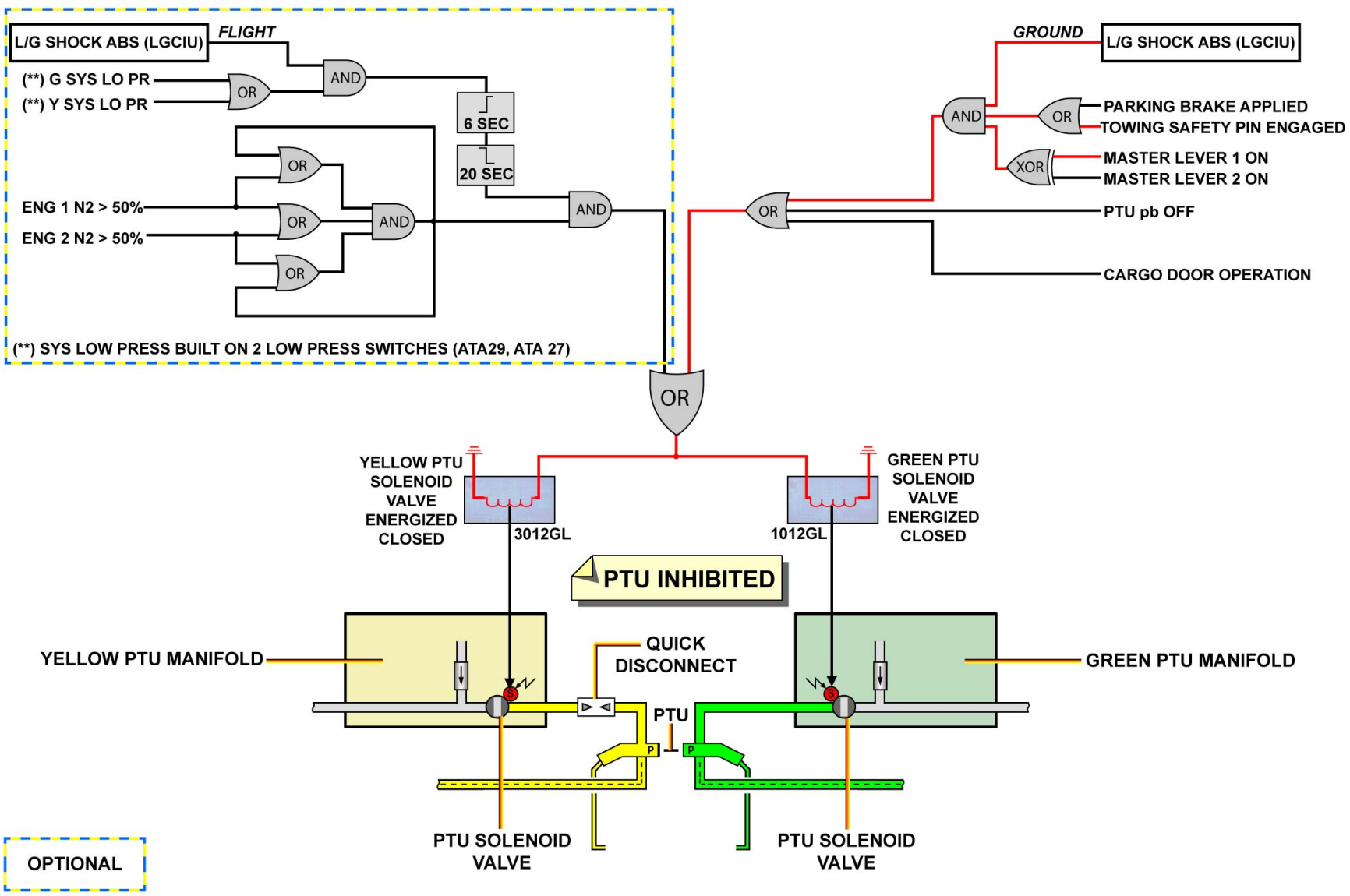

POWER TRANSFER UNIT (PTU) - PTU INHIBITED

BLUE HYDRAULIC SYSTEM D/O (3)

B2 SCOPE

CAUTION: MODULE TAGGED B2 SCOPE.
BE AWARE THAT ONLY AVIONICS/ELECTRICAL TOPICS SHOULD BE LEARNED FOR A T2 COURSE.

RESERVOIR

The reservoir has a direct reading gage, a quantity indicator and a low level switch for ECAM indicating and warning. Normal fill level: 6 l (1.58 US gal). Maximum gageable level: 8 l (2.11 US gal). Low level warning: between 2.0 and 2.3 l (0.52 and 0.6 US gal).

RESERVOIR PRESSURIZATION

The reservoir is normally pressurized with air to prevent pump cavitation. The reservoir is pressurized to 50 psi (3.43 bar) and is sealed to hold the pressure when there is no air supply. The threshold of the air pressure switch is 22 psi (1.52 bar). The threshold of the air pressure relief valve is 77 psi (5.3 bar).

ELECTRIC PUMP

With the ELECtric (ELEC) PUMP P/B set to AUTO, the blue electric pump will run, if one engine is running, or the BLUE PUMP OverRiDe (OVRD) P/B is set to ON, or NLG is not compressed and AC power is available from the APU. With the last condition, at touchdown a time delay relay maintains the pump operation for two minutes after NLG compression. The pump outlet pressure is 3000 psi (206 bar) at zero flow. A temperature switch sends a signal to the ECAM if the pump body temperature exceeds 165°C. The electric pump cooling and lubricating flow goes through the case drain filter installed in the return circuit. Case drain filter clogging indication: $P = 87 \pm 8.7$ psi (6 ± 0.6 bar).

ACOUSTIC FILTER

The acoustic filter is installed in the outlet from the blue electrical pump. It removes the pulses of pressure of the HP flow from the pump. The acoustic filter is an empty metal sphere, with inlet and outlet connections on opposite sides.

RAM AIR TURBINE

The Ram Air Turbine (RAT) is deployed automatically if all AC electrical power sources are lost at speeds greater than 100 kts, or manually by using either one of the guarded P/Bs.

PRESSURE SWITCH

The pressure switch monitors the electric pump pressure for ECAM indications. The threshold of the pressure switch is 1450 psi (99.5 bar). A check valve stops the flow of fluid to the electric pump if the system is pressurized by the RAT.

GROUND COUPLINGS

On ground it is possible to pressurize the blue hydraulic system from a ground power unit.

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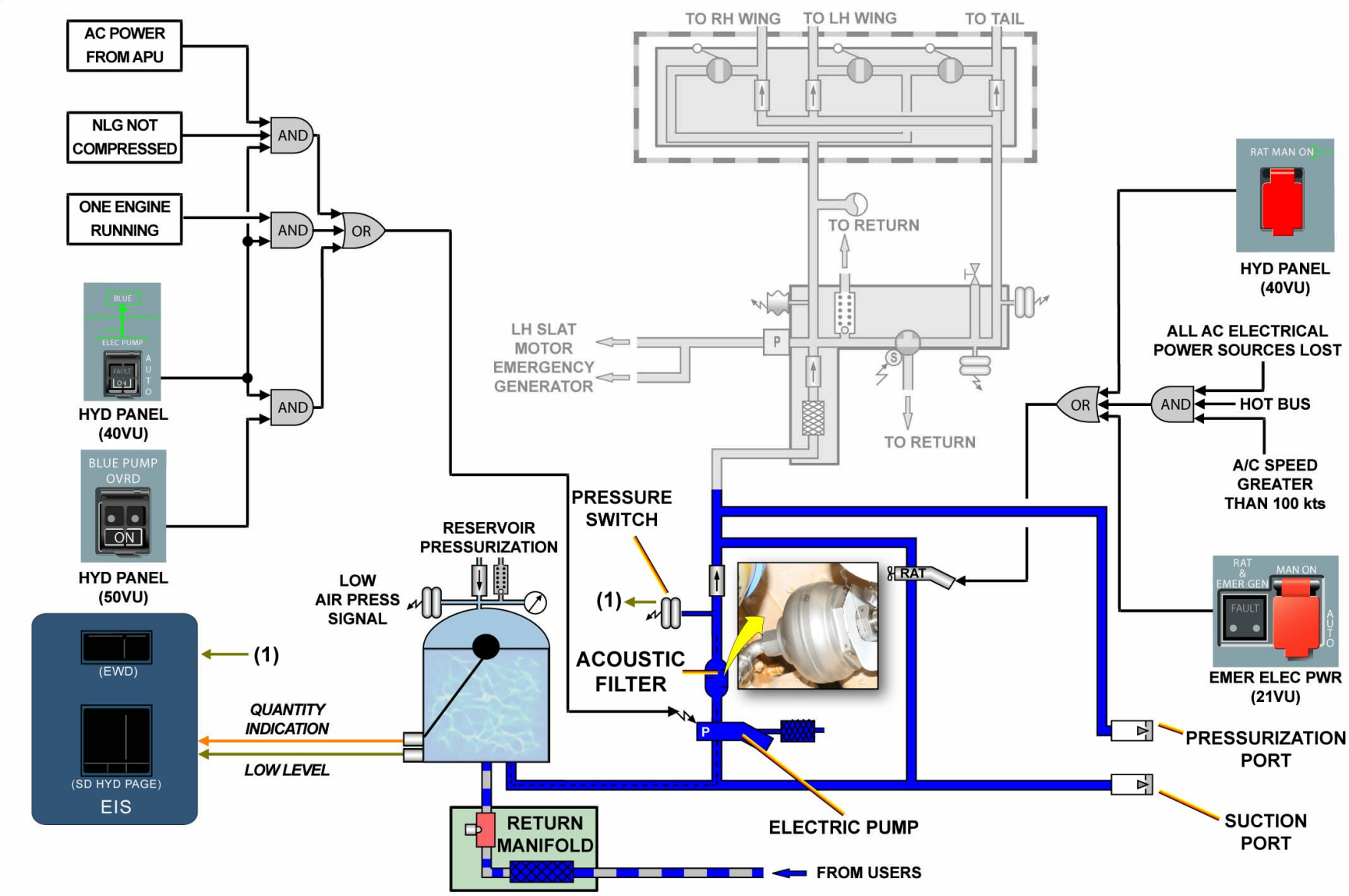

B2 SCOPE ... GROUND COUPLINGS

BLUE HYDRAULIC SYSTEM D/O (3)

CURRENT TRANSFORMER AND PHASE UNBALANCE DETECTOR

The system has a current transformer and a phase unbalance detector which protect the electric circuit from the electric pump. When there is a fault, the detector gets a signal from the current transformer. It uses this signal to stop the supply of power to relay and thus stop the motor. When the unit has operated, it stays in that condition until it is set again. This happens automatically when the supply of power to the unit is stopped (through operation of P/BSW HYD/BLUE/ELEC PUMP) and then started again (and there is no fault signal from the current transformer).

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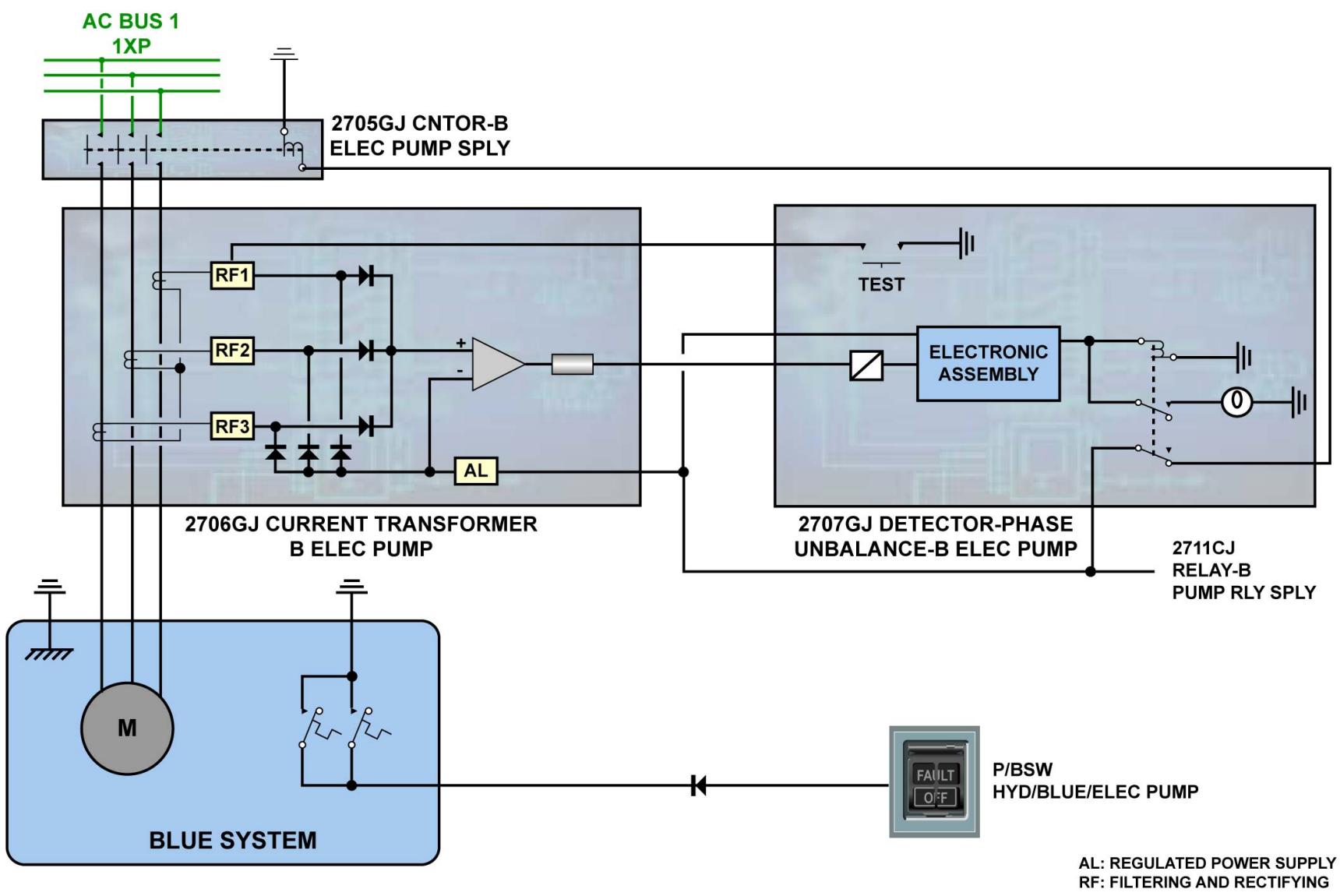

CURRENT TRANSFORMER AND PHASE UNBALANCE DETECTOR

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BLUE HYDRAULIC SYSTEM D/O (3)

HIGH PRESSURE MANIFOLD

The High Pressure (HP) manifold is composed of:
- two pressure switches,
- a pressure transducer,
- a leak measurement valve,
- a HP filter,
- a priority valve,
- a pressure relief valve,
- a sampling valve.

PRESSURE SWITCHES

The signals from both HP manifold pressure switches are sent to the ECAM system and to the Flight Control Computers (FCCs). The threshold of the pressure switches is 1450 psi (99.5 bar).

PRESSURE TRANSDUCER

The pressure transducer gives data for pressure indication on the ECAM and sends information to ELevator Aileron Computers (ELACs) 1 and 2.

LEAK MEASUREMENT VALVE

The leak measurement valve isolates the flight controls when the guarded LEAK MEASUREMENT VALVES P/B on the maintenance panel is set to OFF.

HP FILTER

The HP filter has a clogging indicator. The clogging indicator operates when the differential pressure is higher than 87 ± 8.7 psi (6 ± 0.6 bar).

PRIORITY VALVE

The priority valve makes sure that all available hydraulic pressure is sent to the primary flight controls if pressure in the system is reduced. The threshold of the priority valve is 1842 psi (127 bar).

PRESSURE RELIEF VALVE

The pressure relief valve connects the HP circuit to the return circuit in case of over pressure. The relief valve opens at 3436 psi (237 bar) and closes at 3190 psi (220 bar).

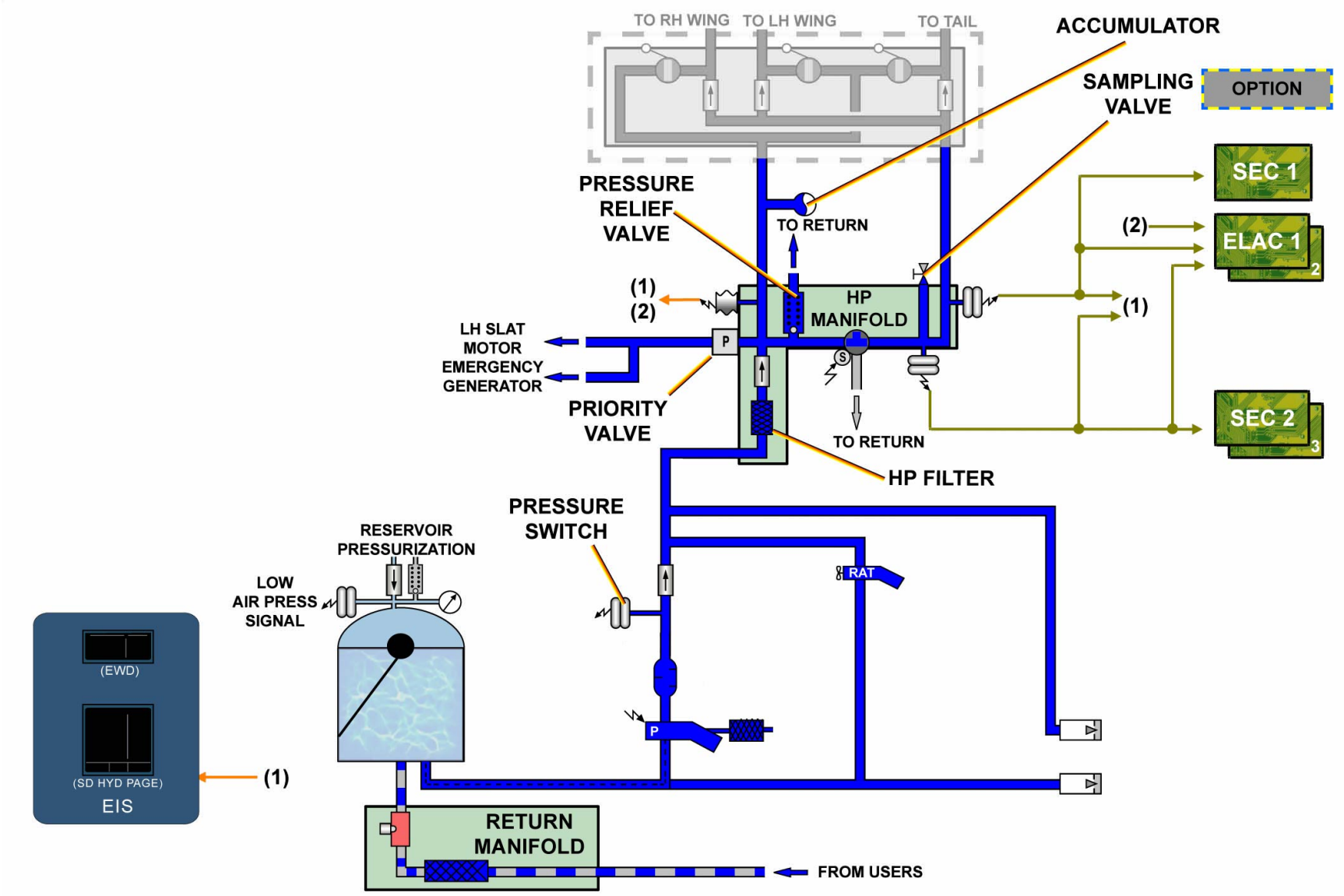
SAMPLING VALVE

A sampling valve is installed on the HP manifold.

NOTE: CAUTION: when sampling, let the fluid run for a moment into a container, then put 0.2L (0.05USG) of fluid into an appropriate bottle for analysis.

ACCUMULATOR

The accumulator acts as a damper for small changes. It also makes a supply of fluid available if there is a demand. The accumulator is pre-charged with nitrogen to 1885 psi (130 bar) at 20°C. When it is full, it holds a total volume of fluid of 1.1 l (0.29 US gal) .



HIGH PRESSURE MANIFOLD & ACCUMULATOR

BLUE HYDRAULIC SYSTEM D/O (3)

LEAK MEASUREMENT MANIFOLD (OPTIONAL)

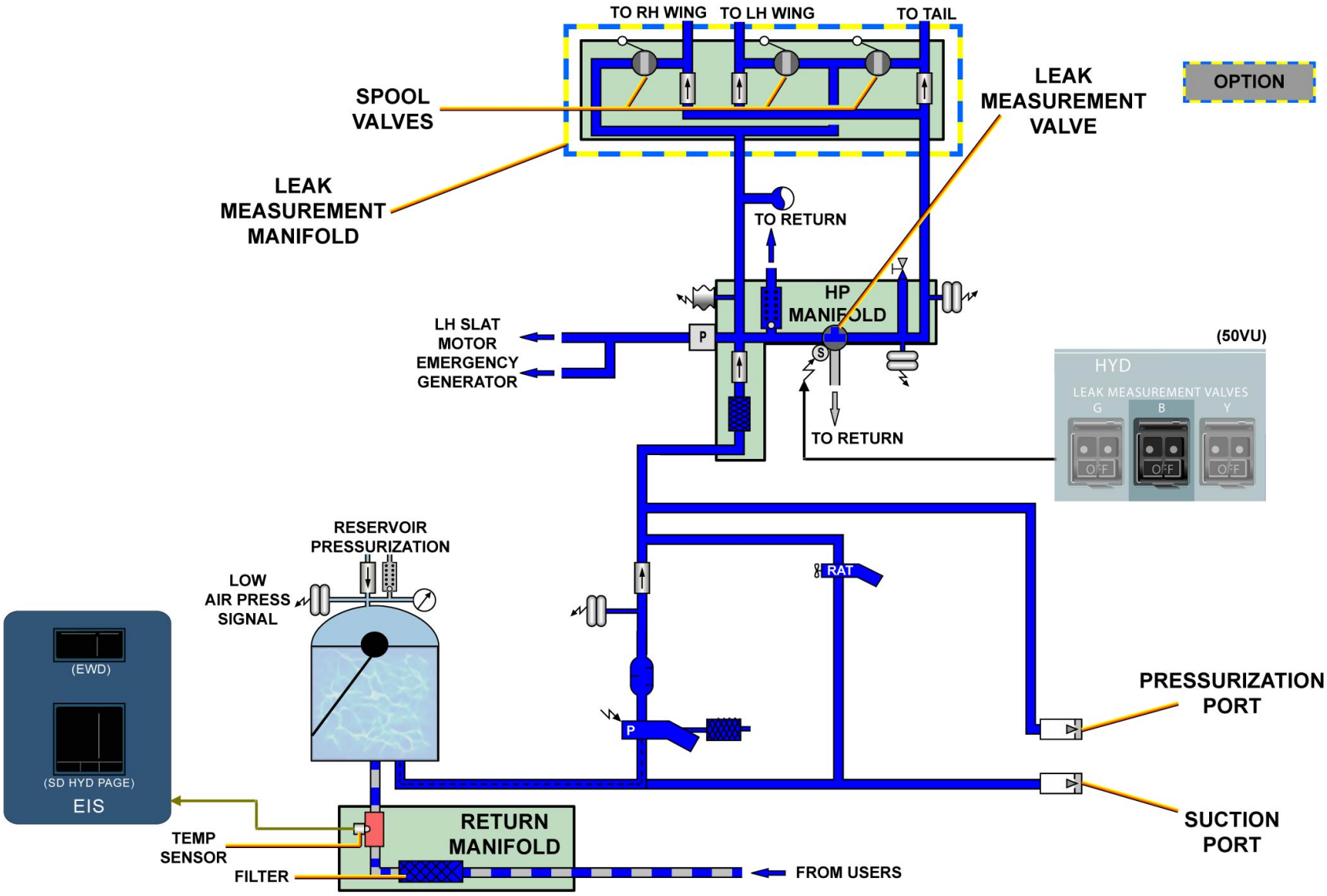
The optional leak measurement manifold supplies the flight controls of the RH wing, LH wing and tail section via three outputs. After closing the related leak measurement valve, operating manually a spool valve lets the related section be supplied for leak measurement testing.

RETURN MANIFOLD

The return manifold comprises:
- one return filter with a clogging indicator and a by-pass device,
- one temperature sensor which has one temperature switch and two temperature transducers.

The red pin of the clogging indicator comes out when the differential pressure across the filter is more than 29 ± 4.4 psi (2 ± 0.3 bar). The by-pass operates when the differential pressure across the filter is more than 58 ± 6.0 psi (4.0 ± 0.4 bar). Then the device allows fluid to go from inlet to outlet without filtration. The temperature switch and temperature transducers send data for ECAM warnings and indication on overhead P/Bs.

UGB13131 - U7ST0M0 - UM29D3000000001



LEAK MEASUREMENT MANIFOLD (OPTIONAL) & RETURN MANIFOLD

UGB13131 - U7ST0M0 - UM29D3000000001

YELLOW HYDRAULIC SYSTEM D/O (3)

B2 SCOPE

CAUTION: MODULE TAGGED B2 SCOPE.
BE AWARE THAT ONLY AVIONICS/ELECTRICAL TOPICS SHOULD BE LEARNED FOR A T2 COURSE.

GENERAL

Most of the system components are installed in the yellow hydraulic compartment, set in the RH belly fairing, FWD of the MLG compartment.

RESERVOIR

The reservoir has a direct reading gauge, a quantity indicator and a low level switch for ECAM indications and warnings.
There are three levels:
- normal fill level: 12 l. (3.17 US gal),
- maximum gaugeable level: 18 l. (4.76 US gal),
- low level warning: 3.0 ± 0.4 l. (0.79 ± 0.1 US gal).

RESERVOIR PRESSURIZATION

The reservoir is normally pressurized with air to prevent cavitation of the pumps. The reservoir is pressurized to 50 psi (3.45 bar) and is sealed by a check-valve to hold the pressure when there is no air supply. The threshold of the LP switch is 22 psi (1.52bar).

FIRE VALVE

The yellow system fire valve installed in the RH wing, inboard of the pylon, is controlled by ENG 2 FIRE P/B. When the valve closes, it stops the supply of fluid from the reservoir to the Engine Driven Pump (EDP).

EDP

The EDP is attached to the accessory gearbox. A solenoid valve controlled by the ENG 2 PUMP P/B selects the pressurized or depressurized mode. The EDP cooling and lubricating flow goes through the case drain filter installed in the return circuit. Pump outlet pressure is 3000 psi (206 bar) at zero flow. The EDP includes a blocking valve which isolates the pump from the hydraulic system when the pump operates in depressurized mode. Case drain filter clogging indication: P = 87 ± 8.7 psi (6 ± 0.6 bar).

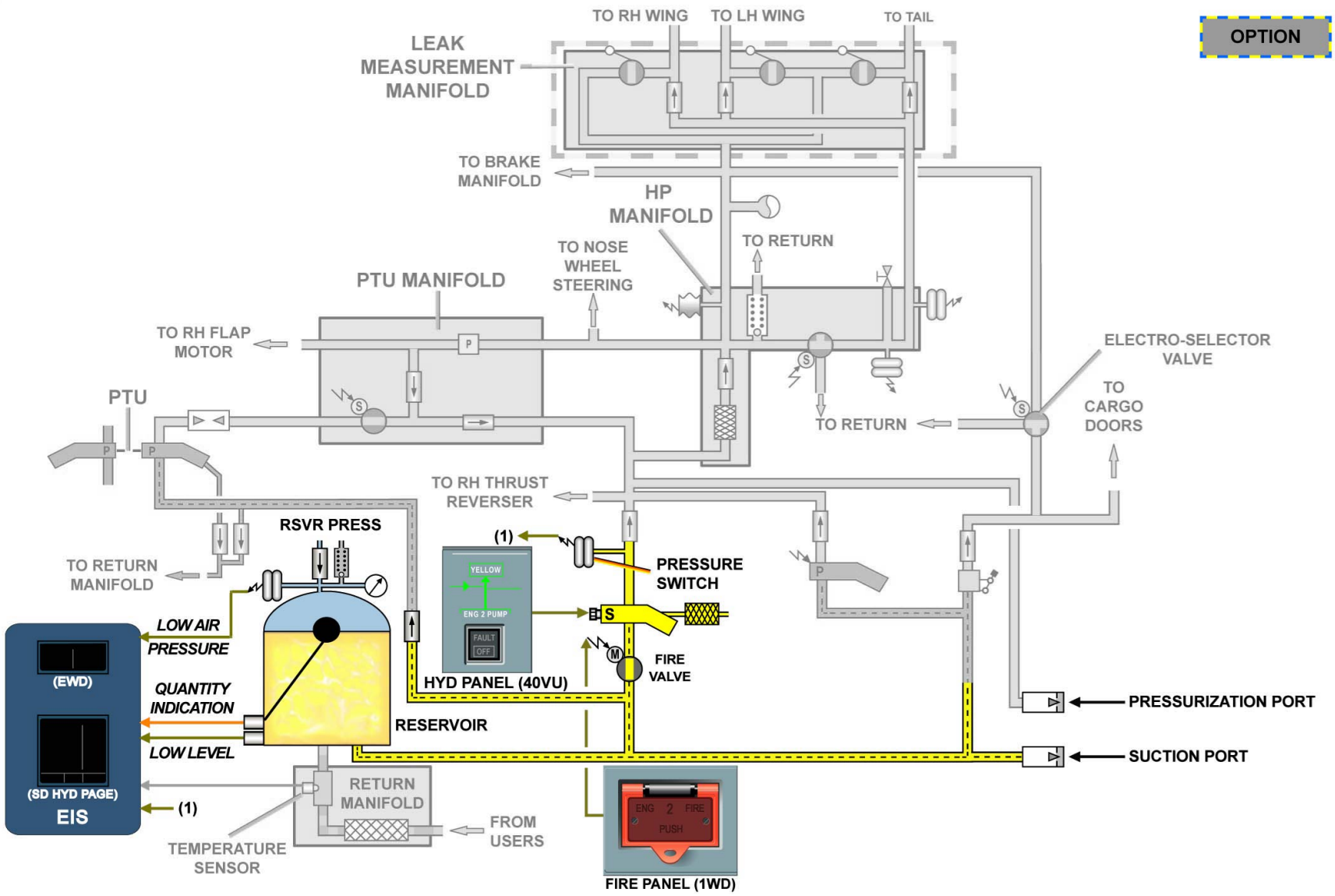
PRESSURE SWITCH

A pressure switch monitors the EDP outlet pressure for ECAM indications. The threshold of the pressure switch is 1740 psi (120 bar).

NOTE: A check valve downstream of the pump stops the fluid flow to the pump if the system is pressurized by the PTU or by the yellow electric pump and the pressure supplied by the EDP is lower.

GROUND COUPLINGS

On the ground it is possible to pressurize the yellow hydraulic system from a ground power unit.



B2 SCOPE ... GROUND COUPLINGS

YELLOW HYDRAULIC SYSTEM D/O (3)

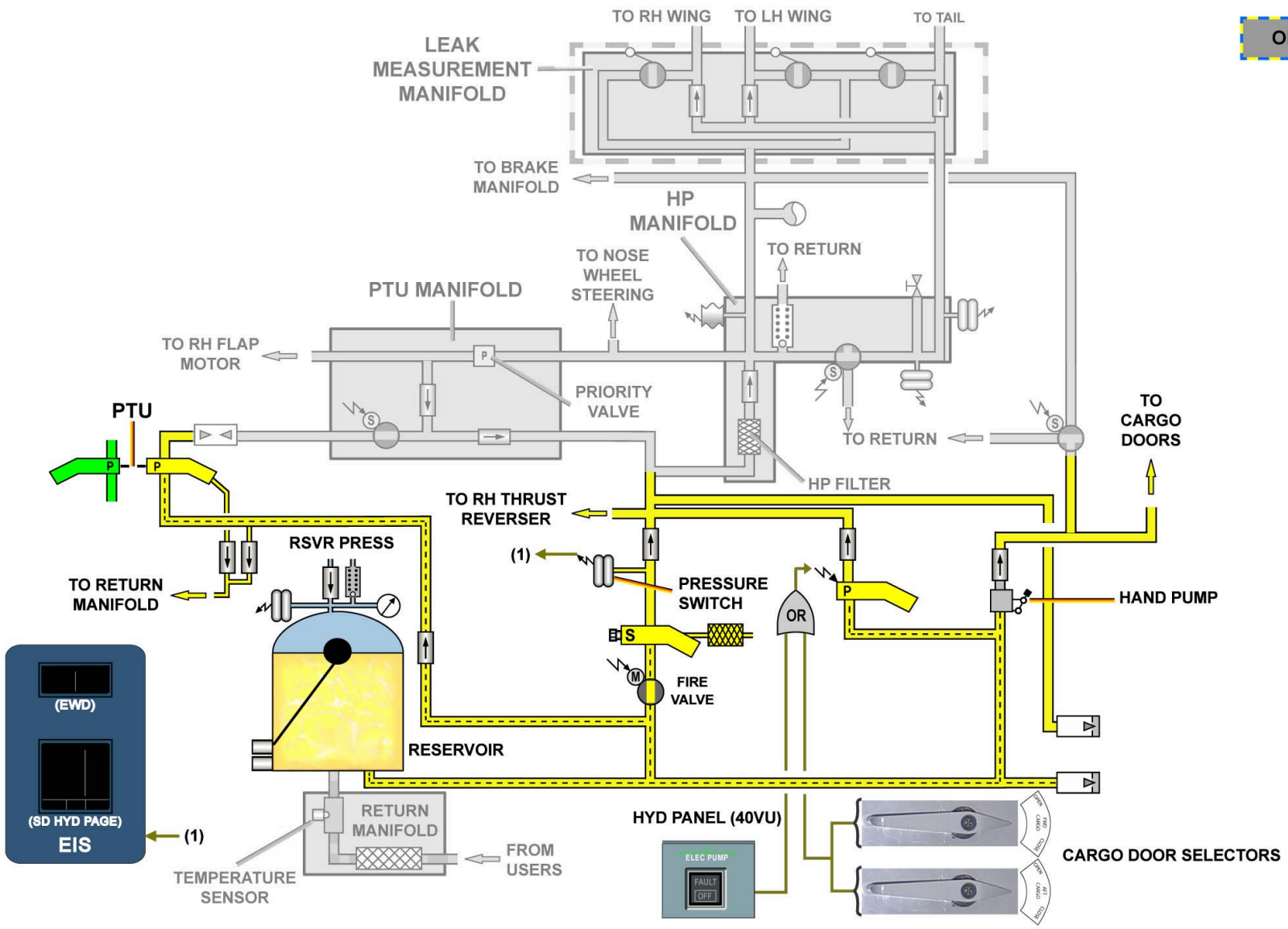
HAND PUMP

The hand pump is installed on the ground service panel of the yellow system and is used for manual cargo door operation only. On ground, when no electrical power is available, the hand pump can be used to open or close the cargo doors.

ELECTRIC PUMP

The yellow electric pump runs if the ELEC PUMP P/B is set to ON, or if a cargo door selector is operated. The electric pump cooling and lubricating flow goes through the return filter. In case of cargo door operation, the PTU is inhibited, the yellow leak measurement valve is closed and a signal is sent to the Slat Flap Control Computer (SFCC) 2 to prevent flaps movement. A check valve downstream of the pump stops the fluid flow to the pump if the system is pressurized from the EDP or the PTU.

UGB13131 - U7ST0M0 - UM29D4000000001



HAND PUMP & ELECTRIC PUMP

YELLOW HYDRAULIC SYSTEM D/O (3)

ELECTRIC PUMP (continued)

CURRENT TRANSFORMER AND PHASE UNBALANCE DETECTOR

The system has a current transformer and a phase unbalance detector which protect the electric circuit of the electric pump. When there is a fault, the detector gets a signal from the current transformer. It uses this signal to stop the supply of power to relay and thus stop the motor. When the unit has operated, it stays in that condition until it is set again. This happens automatically when the supply of power to the unit is stopped (through operation of P/BSW HYD/YELLOW/ELEC PUMP) and then started again (and there is no fault signal from the current transformer).

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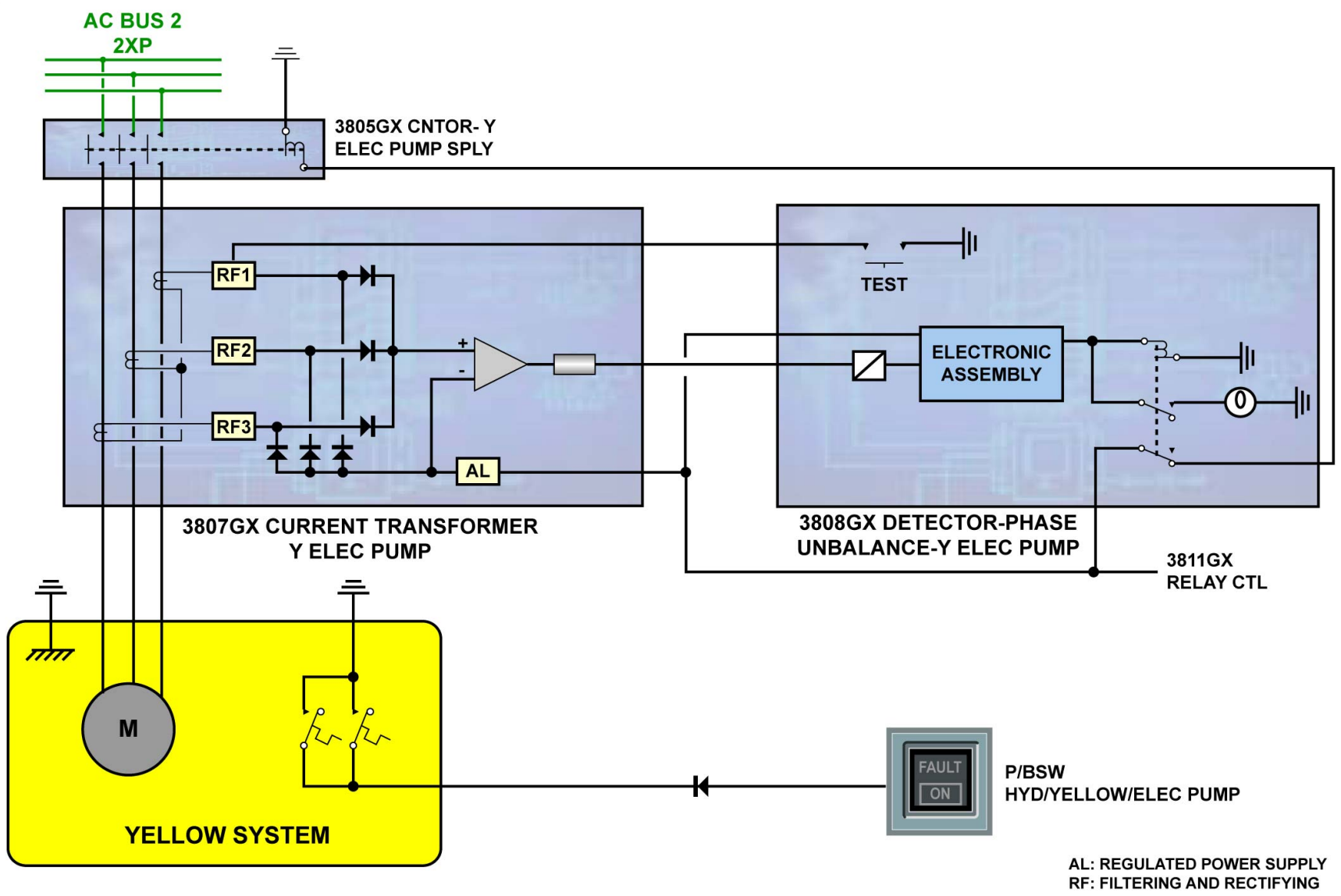

ELECTRIC PUMP - CURRENT TRANSFORMER AND PHASE UNBALANCE DETECTOR

UGB13131 - U7ST0M0 - UM29D4000000001

YELLOW HYDRAULIC SYSTEM D/O (3)

POWER TRANSFER UNIT (PTU)

PTU NORMAL OPERATION (NOT INHIBITED)

The Power Transfer Unit (PTU) will run automatically when the differential pressure between the green and yellow circuits is greater than 500 psi (34.5 bar).

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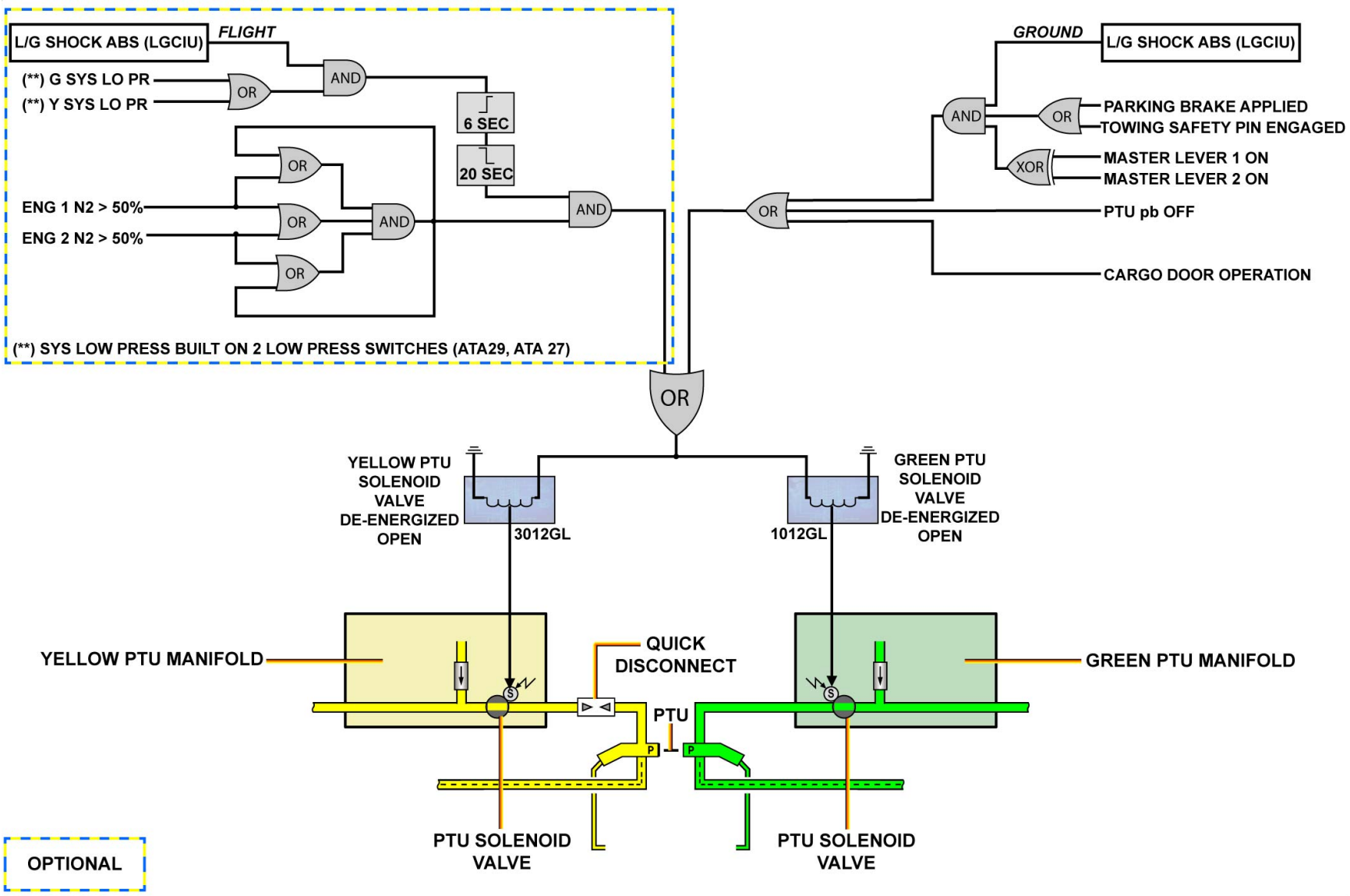

POWER TRANSFER UNIT (PTU) - PTU NORMAL OPERATION (NOT INHIBITED)

YELLOW HYDRAULIC SYSTEM D/O (3)

POWER TRANSFER UNIT (PTU) (continued)

PTU INHIBITED

The PTU operation is inhibited :
- during cargo door operation,
- if the PTU P/B is switched OFF,
- when the A/C is on ground, with one engine running and if the parking brake is set on or the nose wheel steering is disconnected for towing (example: First engine start up during push back) .

As an option, a PTU inhibition logic prevents the PTU from running in overspeed condition (Hyd reservoir low level on one sys) and later on leads to the loss of the second sys (Hyd reservoir overheat on the other sys). In flight, if the PTU is not able to pressurize a hydraulic failed system (G SYS LO PR or Y SYS LO PR) within 6 seconds, either due to external leakage or PTU failure, the PTU is automatically inhibited. This PTU inhibition logic is activated if both engines are running and remains activated as long as one engine is running.
The 20s relay has been installed for the deactivation of the PTU inhibition logic. Once the PTU has been automatically inhibited, the logic is "de-latched" and PTU no longer inhibited 20 seconds after one of the following are met:
- A/C on ground OR,
- Both engines stopped,
- The affected hydraulic system does not longer detect a low-pressure condition.

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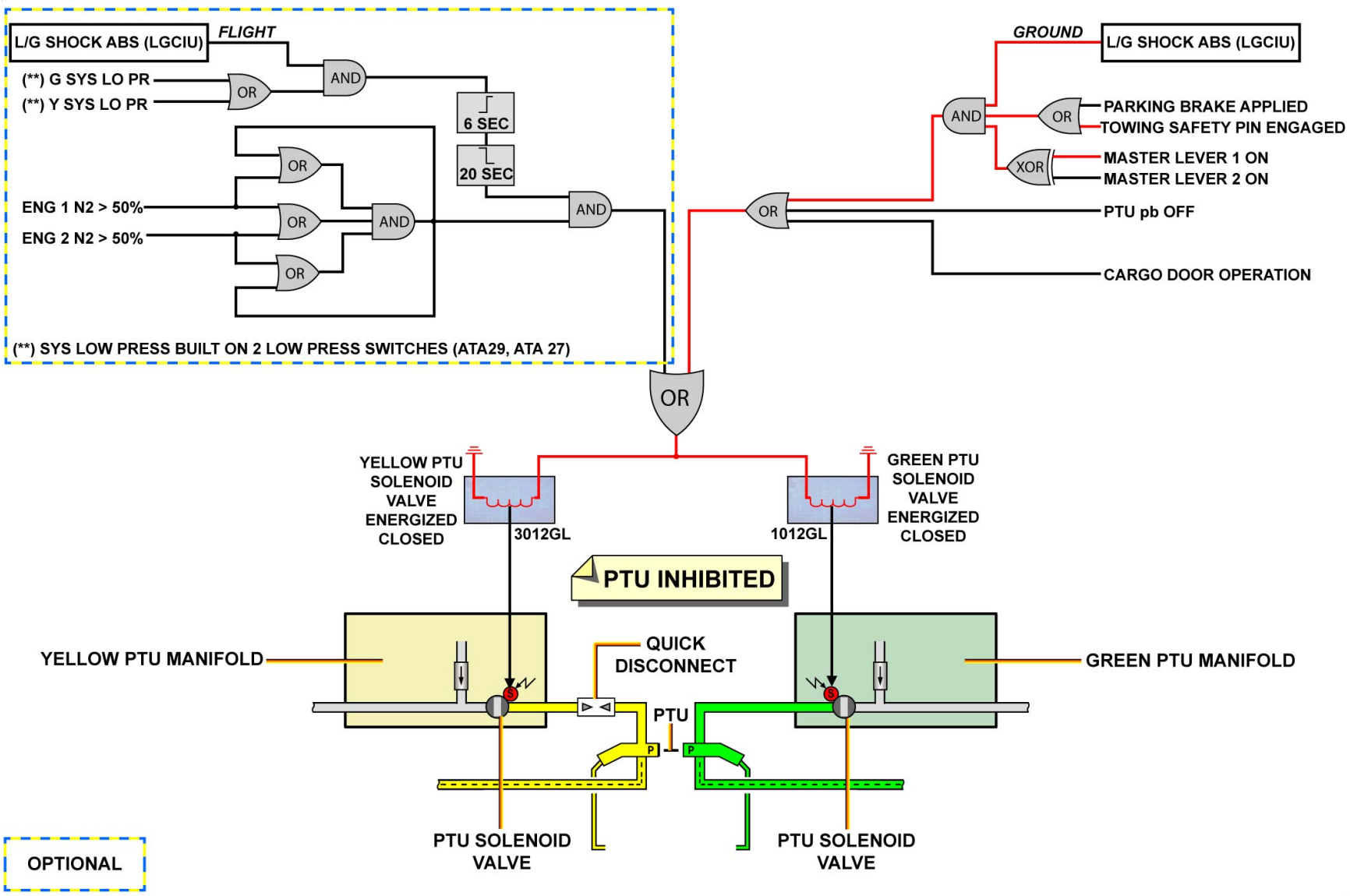

POWER TRANSFER UNIT (PTU) - PTU INHIBITED

YELLOW HYDRAULIC SYSTEM D/O (3)

HP MANIFOLD

The HP manifold supplies the PTU manifold and the leak measurement manifold.

PRESSURE SWITCHES

The signals from both HP manifold pressure switches are sent to the ECAM system, to the Flight Control Computers (FCCs) , to the Flight Augmentation Computer (FAC) 2, the Brake and Steering Control Unit (BSCU) as well as the Alternate Brake Control Unit (ABCU). The threshold of the pressure switches is 1450 psi (99.5 bar).

PRESSURE TRANSDUCER

The pressure transducer gives data for pressure indication on the ECAM and sends information to ELevator Aileron Computers (ELACs) 1 and 2.

LEAK MEASUREMENT VALVE

The leak measurement valve isolates the primary flight controls when the guarded LEAK MEASUREMENT VALVES P/B on the maintenance panel is set to OFF (white OFF light is illuminated). The solenoid valve is automatically closed if the yellow electric pump is energized by using cargo door selectors. This is to prevent any movement of the flight controls.

HP FILTER

The High Pressure (HP) filter has a clogging indicator. The clogging indicator operates when the differential pressure is higher than 87 ± 8.7 psi (6 ± 0.6 bar).

SAMPLING VALVE

A sampling valve is installed on the HP manifold.

NOTE: CAUTION: when sampling, let the fluid run for a moment into a container, then put 0.2L (0.05USG) of fluid into an appropriate bottle for analysis.

PRESSURE RELIEF VALVE

The system relief valve connects the HP circuit to the return circuit in case of overpressure. The relief valve opens at 3436 psi (237 bar) and closes at 3190 psi (220 bar).

ACCUMULATOR

The accumulator acts as a damper for small changes. It also acts as a supply of fluid available in case of request. The accumulator is pre-charged with nitrogen to 1885 psi (130 bar) at 20°C. It holds 1l (0.26 US gal) of total volume of fluid when it is full.

LEAK MEASUREMENT MANIFOLD (OPTIONAL)

The optional leak measurement manifold supplies the flight controls of the RH wing, LH wing and tail section via three outputs. Operating manually, a spool valve lets the associated section of the flight controls be supplied for leak measurement testing.

PTU MANIFOLD

The PTU manifold is composed of one disconnection and two different valves.

QUICK DISCONNECT

The quick disconnect is used for maintenance operations to prevent PTU operation.

SOLENOID VALVE

The solenoid valve installed in the PTU supply line, stops the PTU operation.

PRIORITY VALVE

The priority valve makes sure that all available hydraulic pressure is sent to the primary flight controls if pressure in the system is reduced.

RETURN MANIFOLD

The return manifold comprises:
- one return filter with a clogging indicator and a by-pass device,
- one temperature sensor which has one temperature switch and two temperature transducers.

The red pin of the clogging indicator pops out when the differential pressure across the filter is more than 29 ± 4.4 psi (2 ± 0.3 bar).
The by-pass operates when the differential pressure across the filter is more than 58 ± 6.0 psi (4.0 ± 0.4 bar). Then the device allows fluid to go from inlet to outlet without filtration. The temperature switch and temperature transducers send data for ECAM warnings and indication on overhead P/Bs.

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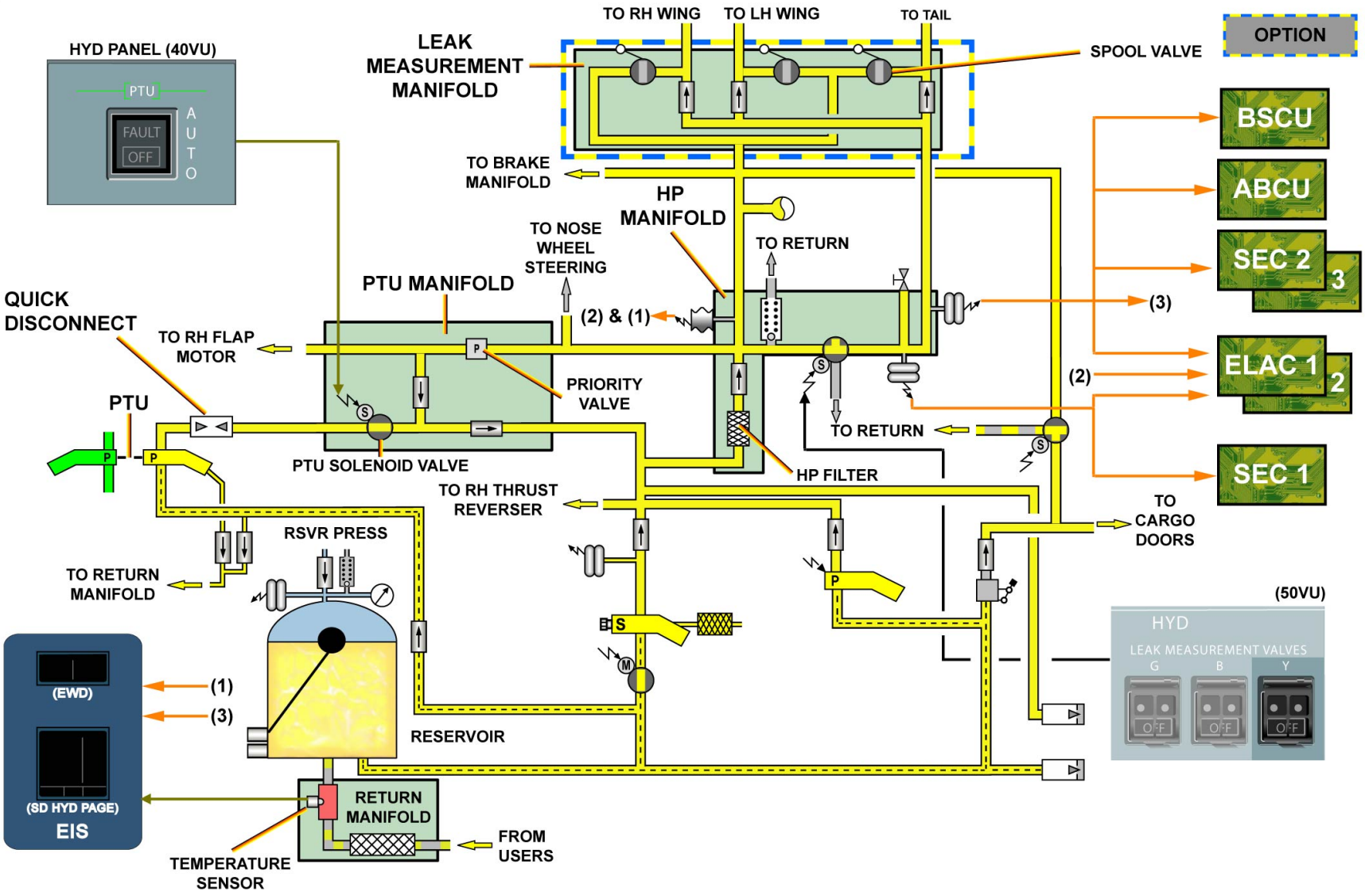

HP MANIFOLD ... RETURN MANIFOLD

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UGB13131 - U7ST0M0 - UM29D4000000001

HYDRAULIC RESERVOIR PRESSURIZING SYS D/O (3)

GENERAL

An air pressure system is provided to pressurize each hydraulic reservoir in order to ensure adequate fluid supply to the pumps. Each reservoir is pressurized by air at 50 psi (3.5 bar). The system also remains airtight in the event of pressurization system failure or after engine shutdown.

SOURCES

The pressure sources are engine 1, via a restrictor or both engines and the APU, via the pneumatic manifold. The pressure sources are:
- the engine 1 High Pressure (HP) compressor for usual operation,
- the pneumatic system in case of loss of engine 1,
- the ground supply.

RESTRICTOR

A restrictor limits the airflow and reduces the temperature of the HP air to a satisfactory level. The restrictor also prevents too much bleed air leakage in case of a leak downstream of the restrictor.

RESERVOIR PRESSURIZATION UNIT

The reservoir pressurization unit controls the pressure of the air supplied to the reservoirs.

PRESSURE REDUCING VALVE

A pressure reducing valve is fitted to the reservoir pressurization unit. In normal operation, the delivery pressure of engine 1 has priority over the pressure supply from the pneumatic manifold. The pressure reducing valve outlet pressure is 50 psi (3.5bar). Two check valves prevent any reverse flow.

GROUND CONNECTOR

Pressurized air from a ground supply cart goes directly to the reservoir pressurization unit through a ground connector.

FILTER

A filter fitted with a clogging indicator is installed in the reservoir pressurization unit to filter the air from the different supply sources.

WATER SEPARATOR

A water separator is installed on the reservoir pressurization unit. It makes sure that the air delivered to the reservoirs is clear of any fluid. There are two drain valves that prevent freezing of the water in the reservoir pressurization unit. One is an automatic drain valve that is opened after each engine or APU shutdown; the other one is a manual self-sealing drain valve.

RESERVOIR CHECK VALVE

Downstream of the reservoir pressurization unit, the air supply is divided into three flows to supply the reservoirs through their related check valve. The green and yellow check valves are installed between the floor beams above the hydraulic bay and the blue one is installed in the aft cargo compartment.

PRESSURE GAGE

An air pressure gage is installed on each hydraulic reservoir to indicate the actual pressure. The pressure switch generates LOW AIR PRESS warning if the pressure is less than 22 psi (1.52 bar).

UGB13131 - U7ST0M0 - UM29D5000000001

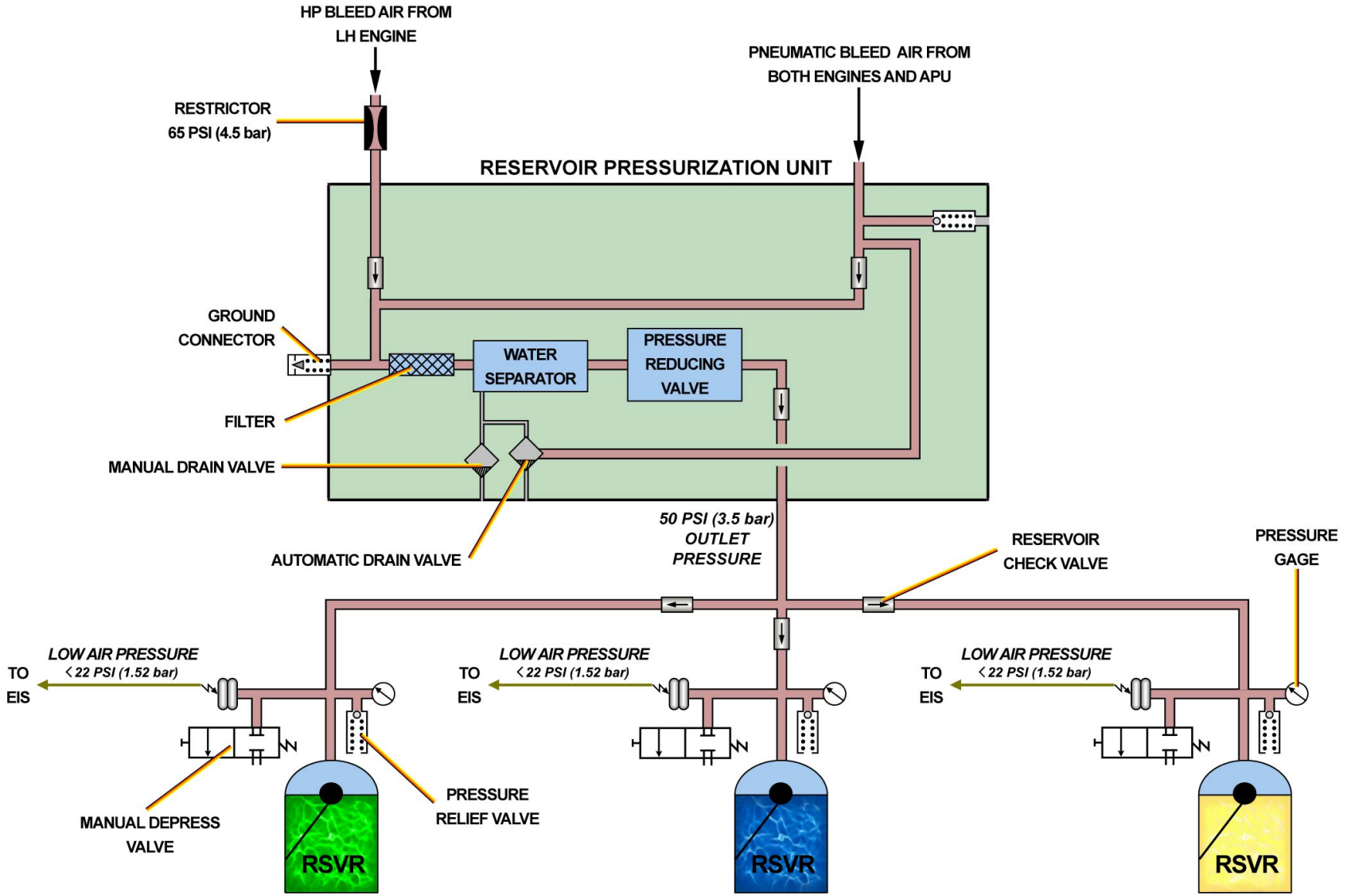
PRESSURE RELIEF VALVE

A pressure relief valve, installed on each reservoir, relieves pressure to the atmosphere in the event of a system overpressure. The threshold of the pressure relief valve is 77 psi (5.3 bar).

MANUAL DEPRESSURIZATION VALVE

A manual depressurization valve is fitted on each ground service panel to depressurize each reservoir.

WARNING: WHEN USING THE MANUAL DEPRESSURIZATION VALVE, PUT ON EYE PROTECTION AND KEEP AWAY FROM THE OUTLET OF THE VALVE. THE AIR CAN BE HOT AND CONTAIN PARTICLES OF DUST AND/OR HYDRAULIC FLUID.



GENERAL ... MANUAL DEPRESSURIZATION VALVE

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UGB13131 - U7ST0M0 - UM29D5000000001

HYDRAULIC RESERVOIR FILLING PRESENTATION (2)

COUPLING SOCKET

The coupling socket is used to fill the reservoir from a pressurized ground hydraulic supply. The coupling socket includes a check valve.

RESTRICTOR

A restrictor located between the coupling socket and the reservoir filling selector valve protects the system against over pressure.

HAND PUMP

The hand pump is used to refill the reservoirs if no ground cart is available. The hand pump lever is on the yellow ground service panel. A specific filling valve including a filter and a check valve is installed on the hand pump.

FILTER

The filter of the reservoir filling system is equipped with a clogging indicator.

NOTE: Note: No bypass possibility on this filter.

RESERVOIR FILLING SELECTOR VALVE

The reservoir filling selector valve directs the hydraulic fluid from the supply source to the reservoir of the selected system. Do not depressurize the hydraulic reservoir to refill it. In the NEUTRAL position, an internal thermal relief valve protects the selector valve from thermal expansion of the fluid.

RESERVOIR QUANTITY INDICATOR

A reservoir quantity indicator allows refilling monitoring. It shows the contents of the selected hydraulic reservoir that is indicated by one of the three colored lights. The direct reading gages are used if no electrical power supply is available.

CHECK VALVE

The hydraulic fluid is sent to the reservoirs via a check valve and the filter of the low-pressure return circuit. The check valves isolate the main hydraulic systems from the reservoir filling system when it is not in use.

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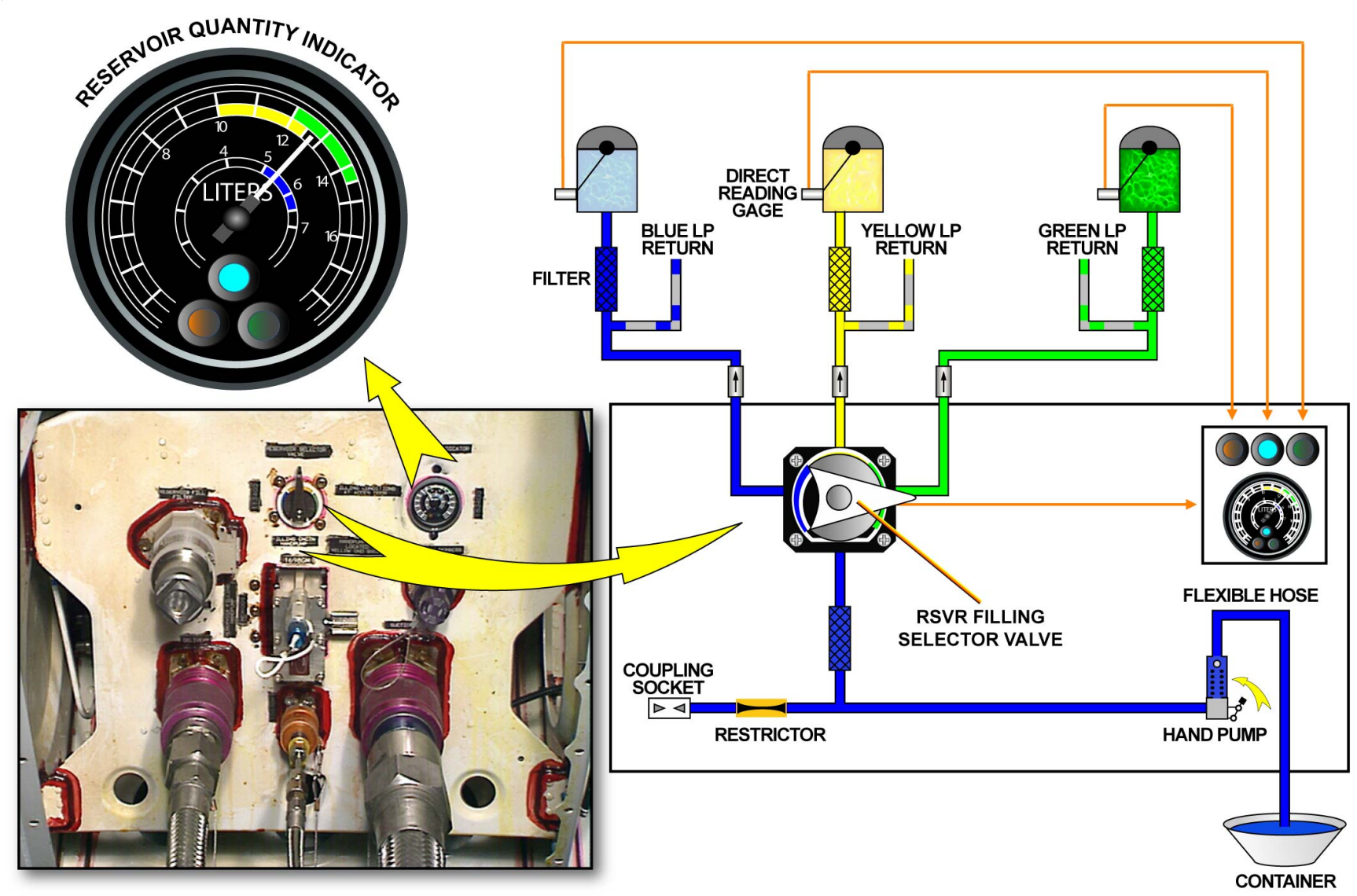

COUPLING SOCKET ... CHECK VALVE

SEAL DRAIN SYSTEM DESCRIPTION (3)

GENERAL

The seal drain system collects hydraulic fluid from the seal drains of some hydraulic components. The hydraulic fluid that may escape from some hydraulic components in the form of leak or abnormal condition, such as hydraulic reservoir overfilling or internal overpressure, is drained into collector tanks.

FWD SYSTEM

The FWD system consists of flexible hoses and rigid pipes connected to a collector tank. The FWD collector tank is attached between frames 40 and 41 in the yellow hydraulic compartment. The components which are drained into the FWD collector tank located in the yellow hydraulic compartment are:
- blue electric pump,
- yellow electric pump,
- slats Power Control Unit (PCU),
- green hydraulic reservoir,
- yellow hydraulic reservoir.

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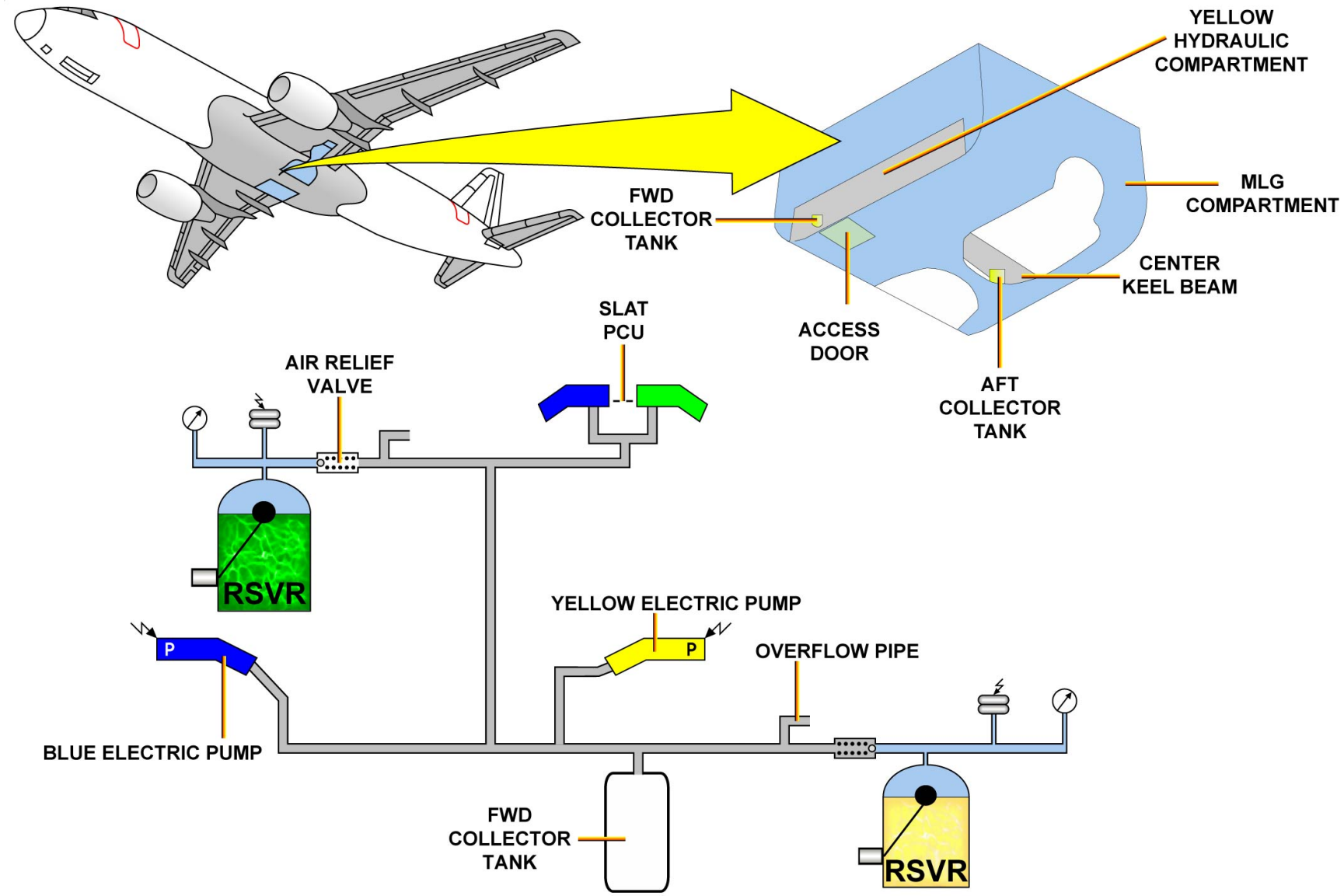

GENERAL & FWD SYSTEM

UGB13131 - U7ST0M0 - UM29P4000000001

SEAL DRAIN SYSTEM DESCRIPTION (3)

AFT SYSTEM

The AFT system consists of flexible hoses and rigid pipes connected to a collector tank. The AFT collector tank is attached to the right side of the keel beam in the main hydraulic compartment. The components which are drained into the aft collector located in the main landing gear compartment are:

- flaps PCU,
- Power Transfer Unit (PTU),
- Constant Speed Motor/Generator (CSM/G),
- blue hydraulic reservoir.

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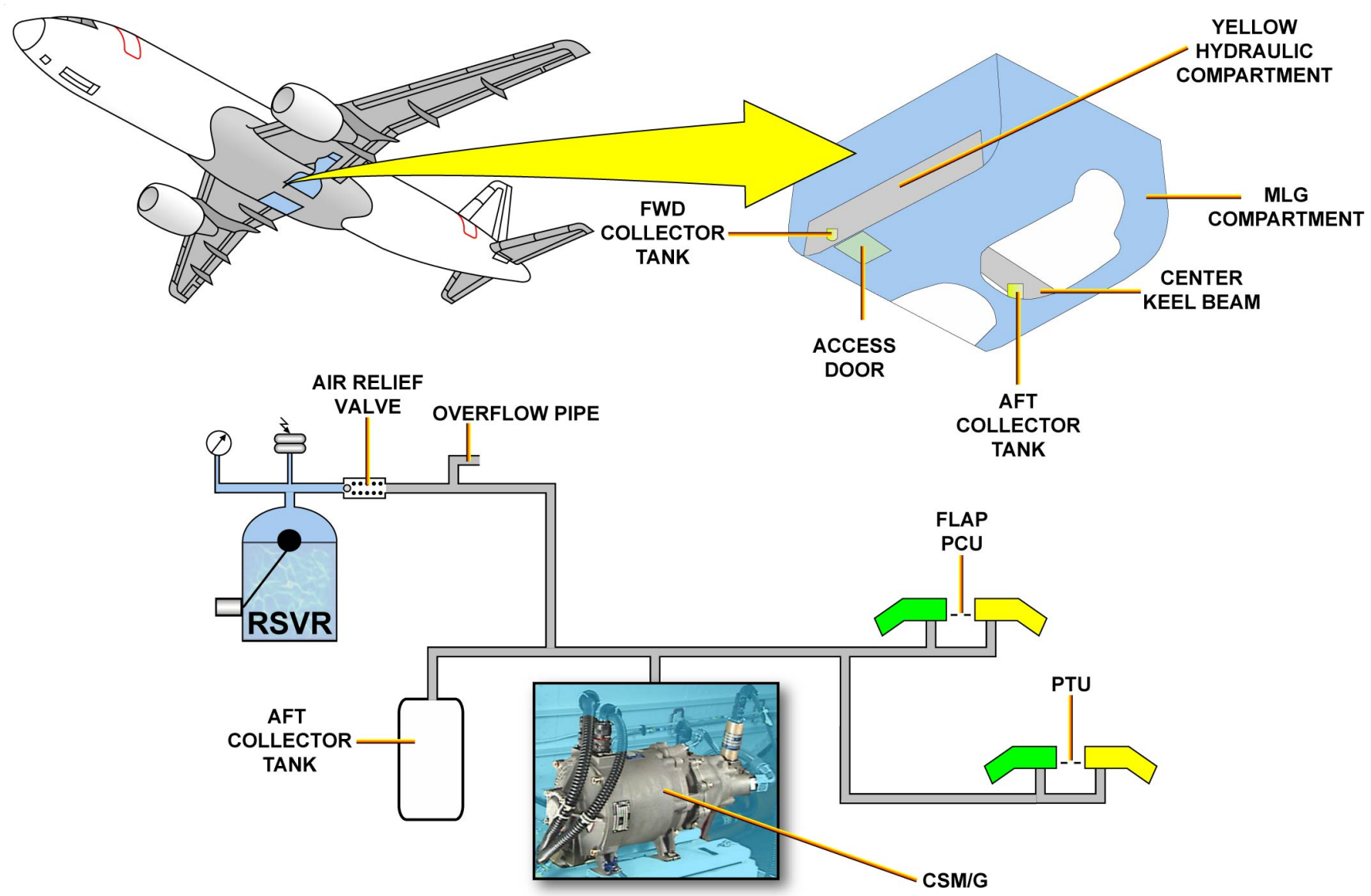
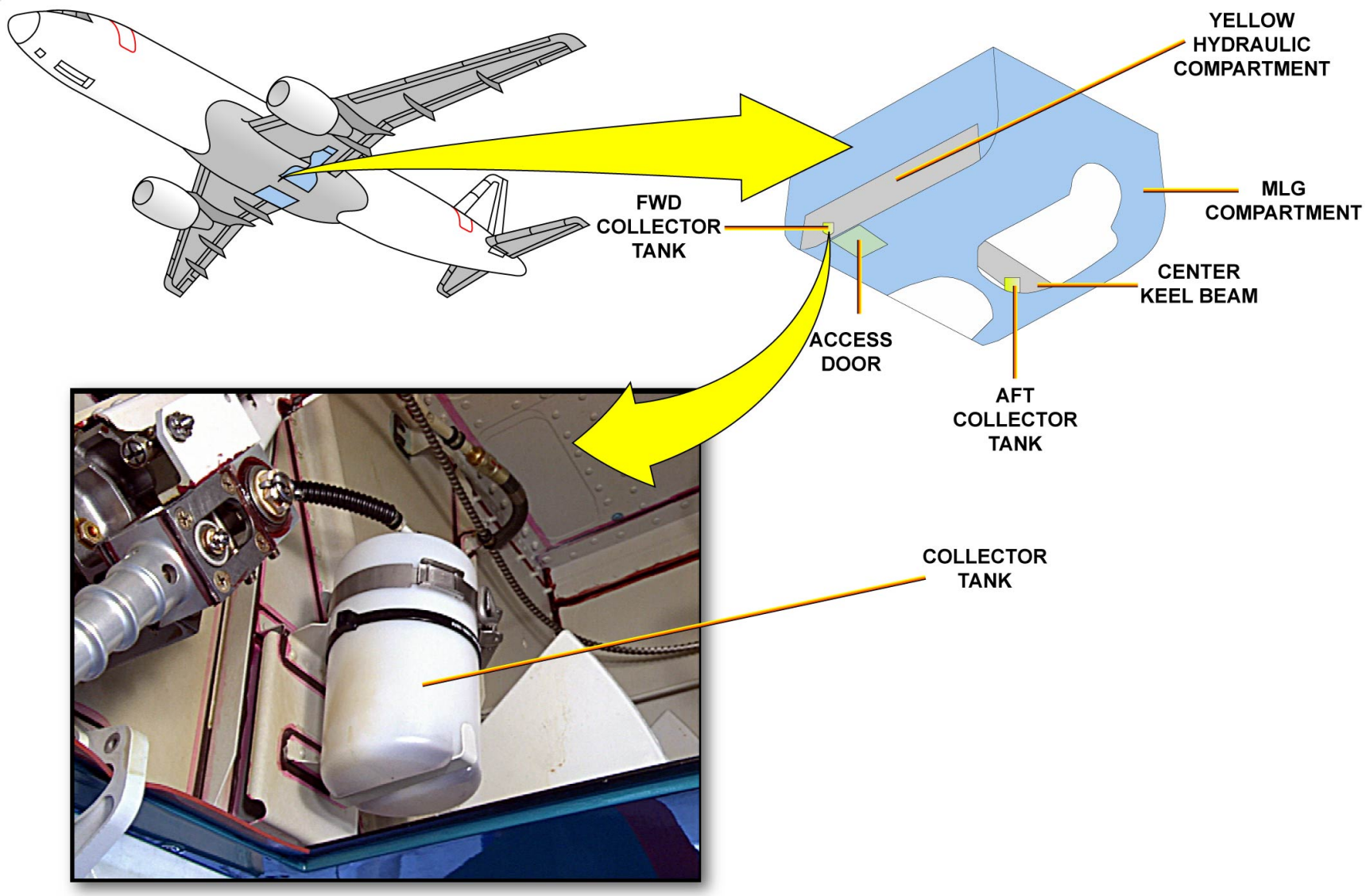

YELLOW
HYDRAULIC
COMPARTMENT
MLG
COMPARTMENT
FWD
COLLECTOR
TANK
CENTER
KEEL BEAM
ACCESS
DOOR
AFT
COLLECTOR
TANK
AIR RELIEF
VALVE
OVERFLOW PIPE
RSVR
FLAP
PCU
PTU
AFT
COLLECTOR
TANK
CSM/G

AFT SYSTEM

SEAL DRAIN SYSTEM DESCRIPTION (3)

TANK DRAINAGE

The system is designed so that the hydraulic fluid drains into the collector tanks by gravity. The collector tanks attached to the aircraft structure by means of quick release clamps must be removed for drainage. Each collector tank, which has a capacity of 0.75 liters (0.19 US Gal), must be emptied and cleaned at regular intervals.



TANK DRAINAGE

HYDRAULIC POWER SYSTEM OPERATION, CONTROL & INDICATING (3)

3 HYDRAULIC SYSTEMS PRESSURIZATION WITH ELECTRICAL PUMPS

PTU & ENGINE PUMP OPERATION

RESERVOIR OVERHEAT FAILURE

UGB13131 - U7ST0M0 - UM29IZLEVEL0302

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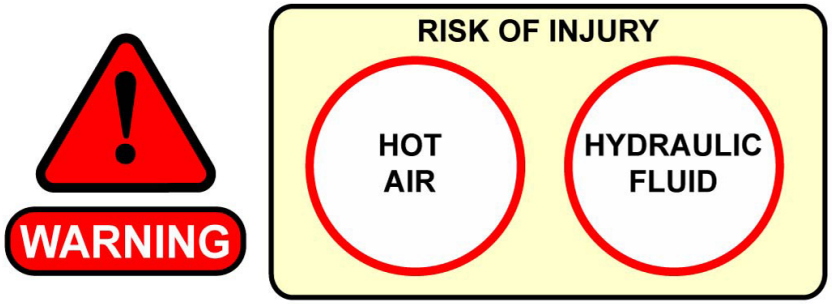
RESERVOIR DEPRESSURIZATION/PRESSURISATION (2)

WARNING

WARNING: PAY ATTENTION TO PROTECT YOUR HANDS AND YOUR FACE FROM THE AIR WHICH COMES OUT WHEN YOU OPEN RESERVOIR MANUAL DEPRESSURIZATION VALVES. THE AIR MAY BE HOT AND CONTAIN HYDRAULIC FLUID. USE APPROPRIATE SAFETY WEAR.

UGB13131 - U7ST0M0 - UM29Y1000000001


WARNING
RISK OF INJURY
HOT AIR
HYDRAULIC FLUID

USE APPROPRIATE SAFETY WEAR

RESERVOIR DEPRESS
2087GM
BLUE RESERVOIR DRAIN
2264GM

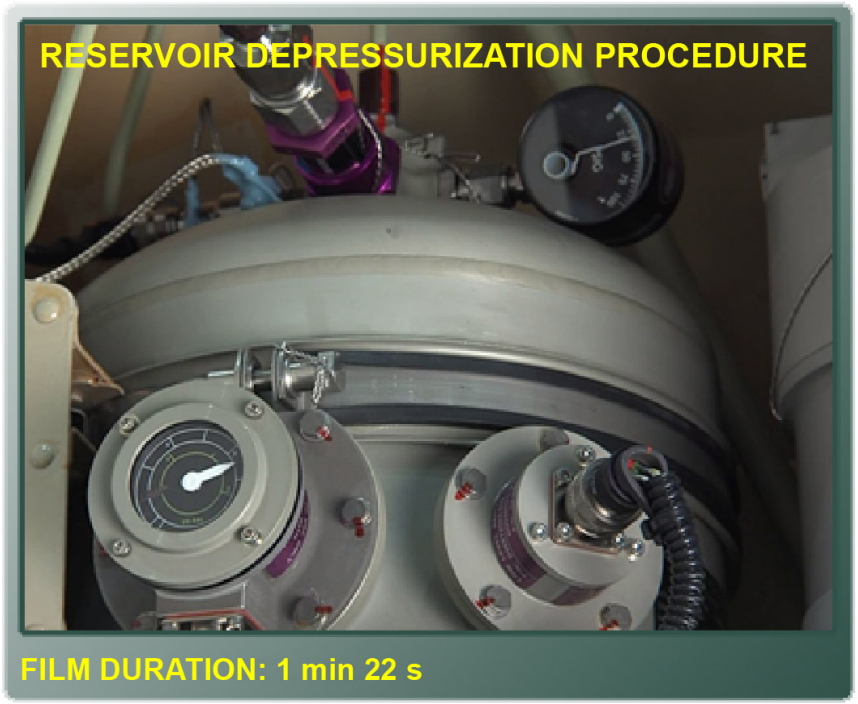
WARNING

RESERVOIR DEPRESSURIZATION/PRESSURISATION (2)

DEPRESSURIZATION OPERATION

Make sure the hydraulic system will not be pressurized during this task.
Open the access panel to the hydraulic ground service panel.
The direct reading gauge on the reservoir will show the actual air pressure inside the reservoir.
Wear the proper protection when you open the depressurizing valve. The air can be hot and contain hydraulic fluid.
The gauge on the reservoir will show the decrease in pressure.
Make sure the valve is completely closed.
If the reservoir needs to be depressurized for a longer time during a maintenance task, a special tool needs to be installed. Unscrew the normal depressurizing valve and install the maintenance tool to prevent unwanted pressure build up.

UGB13131 - U7ST0M0 - UM29Y1000000001



DEPRESSURIZATION OPERATION

RESERVOIR DEPRESSURIZATION/PRESSURISATION (2)

PRESSURIZATION OPERATION

Pressurization of a Hydraulic Reservoir:
- Remove the maintenance tool and install the normal depressurization valve to ensure pressurization of the reservoir.
- Open the access panel of the blue hydraulic compartment.
- Connect the nitrogen pressure hose to the Air Pressure Manifold.
- Adjust the nitrogen pressure (to 50 PSI) according to the pressure gauge on the reservoir.
- Disconnect the pressure hose and close the access panels.

UGB13131 - U7ST0M0 - UM29Y1000000001

PRESSURIZATION OPERATION

RESERVOIR FILLING (2)

WARNING

WARNING: IF YOU GET THE FLUID ON YOUR SKIN OR IN YOUR EYES:
- FLUSH IT AWAY WITH CLEAN WATER,
- GET MEDICAL AID.

MAKE SURE THAT THE TRAVEL RANGES OF THE FLIGHT CONTROL SURFACES ARE CLEAR BEFORE YOU PRESSURIZE/DEPRESSURIZE A HYDRAULIC SYSTEM.

FOLLOW THE HYDRAULIC SAFETY PROCEDURES. PRECAUTIONS HAVE TO BE TAKEN BEFORE STARTING HYDRAULIC RESERVOIR FILLING OPERATION. MAKE SURE THAT:
- THE SPEED BRAKES AND SPOILERS ARE RETRACTED,
- THE THRUST REVERSERS ARE STOWED (CFM-56 ENGINE ONLY),
- THE L/G IS EXTENDED AND THE DOORS ARE CLOSED,
- THE FWD AND AFT CARGO COMPARTMENT DOORS ARE CLOSED.

PRECAUTION

Before starting with the filling procedure, all flight control surfaces must be in their neutral retracted position, thrust-reversers retracted and the cargo-doors must be in the closed position.

When the flight control surfaces are retracted, place warning notices to prevent others from moving the flight control surfaces.

Select the hydraulic page on the system display and make sure that the hydraulic systems are completely depressurized.

Makes sure that the system accumulator is pre-pressurized to the correct value and that the hydraulic system reservoir is correctly pre-pressurized with air.

Pressurize the yellow hydraulic circuit with the yellow electric pump. The PTU should be in the OFF position to make sure only the yellow system will be pressurized.

When the electric pump is selected to OFF, the triple indicator should show the brake accumulator as being fully pressurized to 3000 PSI.

Place a warning notice to tell persons not to operate the hydraulic system.

Open the Green and Yellow Hydraulic Ground Service Panel. Remove the hand pump lever from the yellow panel and assemble it, so it can be used on the Green Service Panel Hand Pump.

Make sure to wear the proper protection gloves and goggles before removing the flexible hose from its housing. Connect the hose to the hand pump and insert it into a new canister of hydraulic fluid.

Select the hydraulic system that needs to be filled. The selection is confirmed by a colored LED on the indication panel.

Install the hand pump lever on the pump and start the filling operation.

Fill the system reservoir to the last white line in the related colored band and not to the end of the scale. Put the selector back to Neutral.

Remove the hose from the hand pump and clean and dry the hose and its connections to prevent spillage. Install blanking caps on the pump and hose.

Re-install the hose in the housing.

Remove the hand pump lever and re-assemble it in its stowing configuration and install it on the yellow service panel.

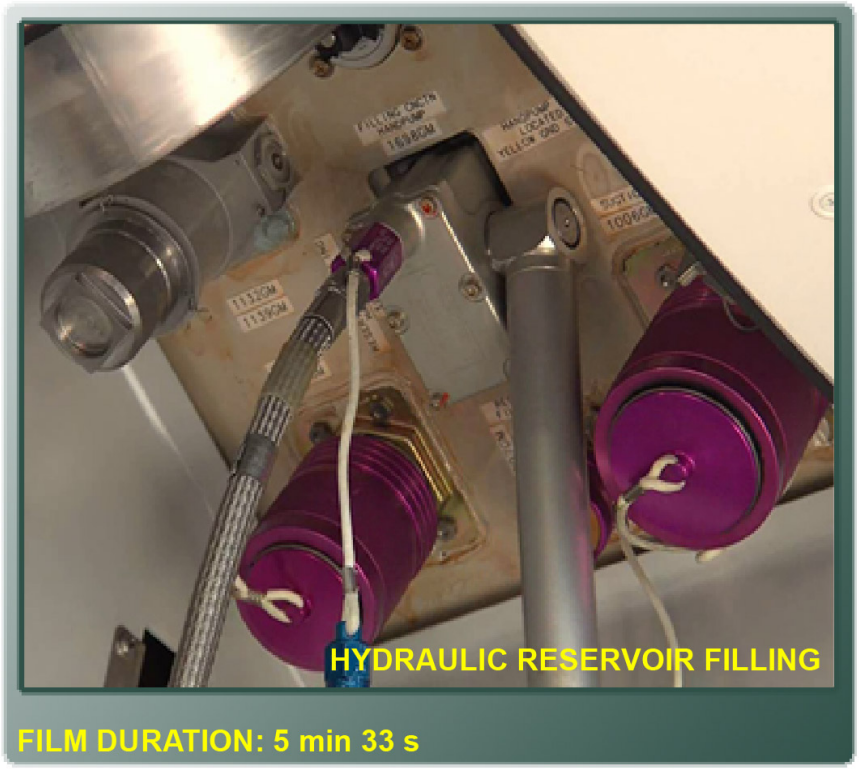
Close the service panels.

If a reservoir is overfilled, it must be drained. Connect the flexible hose to the drain connector.

NOTE: Do not forget to depressurize the reservoir before opening the drain valve.

UGB13131 - U7ST0M0 - UM29Y2000000001

Use a container of sufficient size to collect the excess fluid from the reservoir.
Open the drain connector until the required reservoir level is reached.
Remove the flexible hose and clean the connection. Re-pressurize the reservoir before operation of the system.
Remove the warning notices and check the hydraulic system page for correct level indication.



WARNING & PRECAUTION

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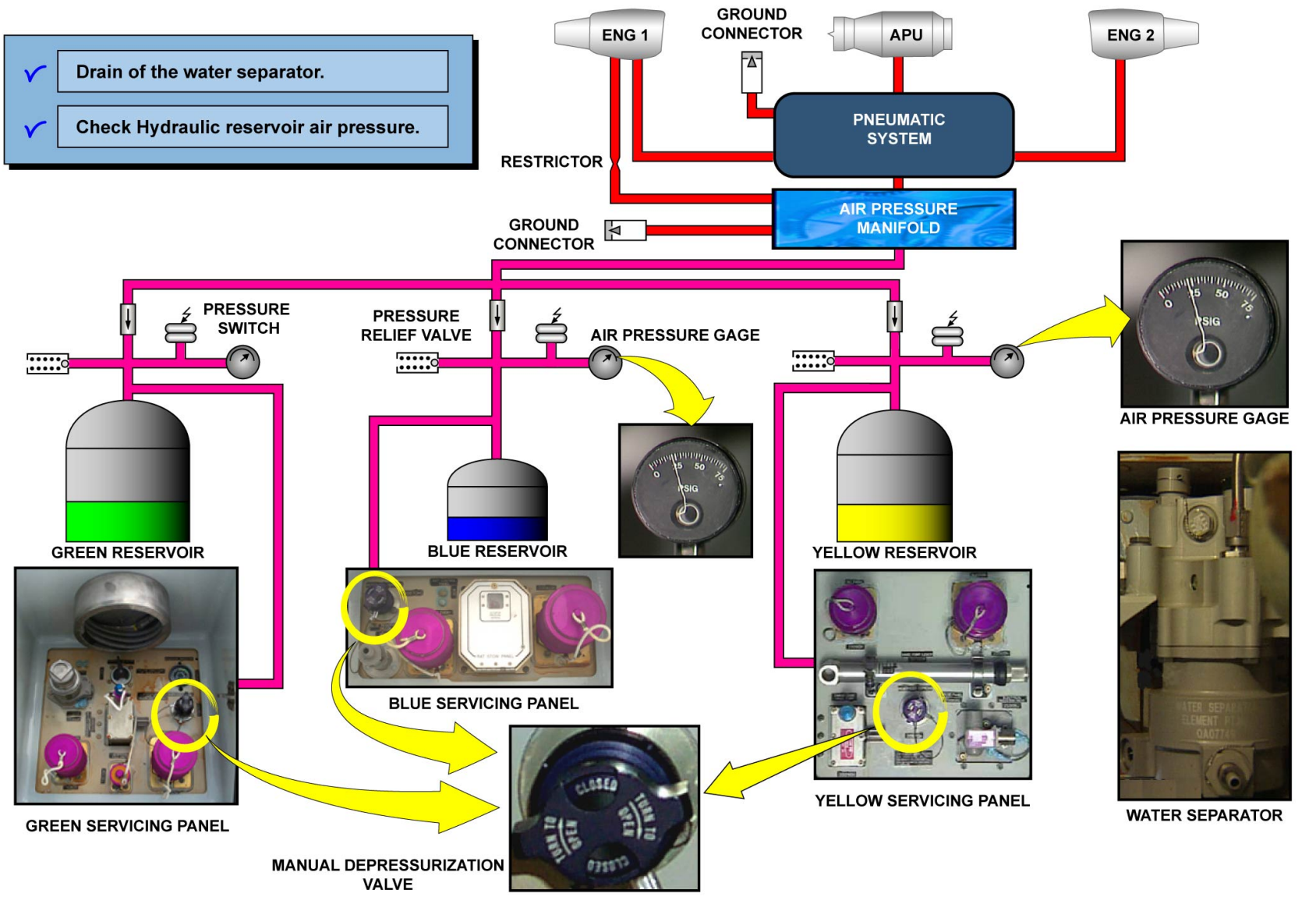
UGB13131 - U7ST0M0 - UM29Y2000000001

HYDRAULIC POWER SYSTEM LINE MAINTENANCE (2)

SERVICING

RESERVOIR AIR PRESSURIZATION

All three reservoirs are pressurized to 50 psi to prevent pump cavitation.
The non-return valves are in each reservoir supply manifold. Make sure that the pressure is kept for until 12 hours after engine shutdown on ground and for until 3 hours after a failure of the air supply in flight.
Each reservoir has a depressurization valve on its related service panel.
For long time depressurization, a depressurization tool can be installed on the depressurization valve.
A 77 psi pressure relief valve is installed onto the supply manifold at each reservoir.
All three reservoirs are pressurized directly from Engine 1 for normal supply and from the bleed air system for alternate supply at 43 psi.
The air pressurization manifold has a ground supply connection.
It is put into the blue hydraulic bay and adjusts the normal or ground supply to 50 psi.
There are two water drains: one is automatic after engine and APU shutdown, and the other is manually operated.
After maintenance on the hydraulic system, the reservoir pressurization can be done with a pneumatic ground cart connected to the reservoir pressure unit, the APU or the pneumatic system ground connection.



SERVICING - RESERVOIR AIR PRESSURIZATION

HYDRAULIC POWER SYSTEM LINE MAINTENANCE (2)

SERVICING (continued)

FLUID LEVEL CHECK

The following Aircraft Configuration is needed for a correct fluid level check and servicing:
- the speed brakes and spoilers must be retracted,
- the thrust reversers stowed,
- the cargo doors closed,
- all system accumulators empty of fluid and pressurized with nitrogen to the correct pressure,
- the accumulators pre-charge pressure must be checked,
- the reservoirs are pressurized with air,
- the landing gear must be in down position with the landing gear doors closed (one door may be open),
- and the brake accumulator may be pressurized with fluid.

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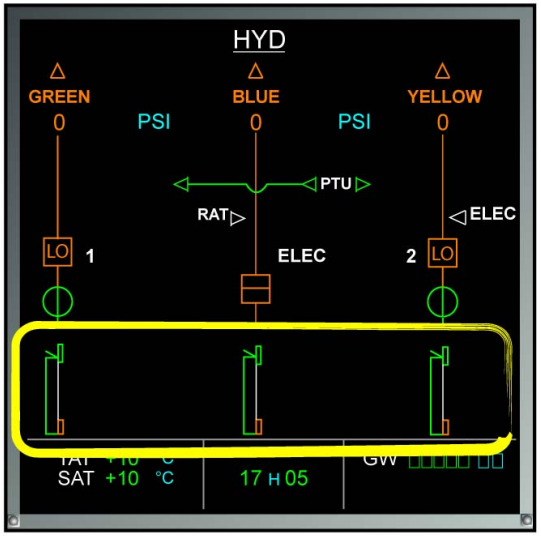
✓ Check air pressure.

AIR PRESSURE GAGE

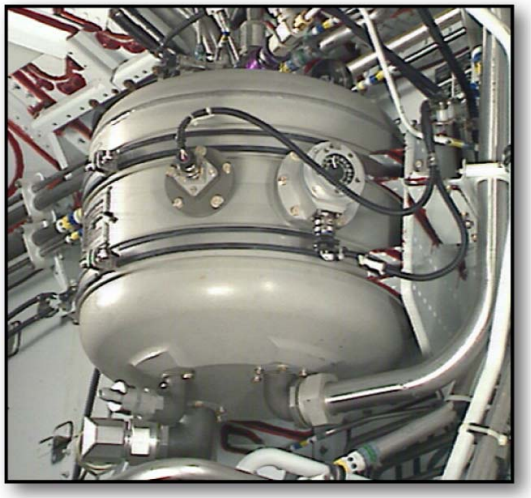
✓ Check fluid quantity on the ECAM or on the direct reading gage.

FLUID QUANTITY GAGE

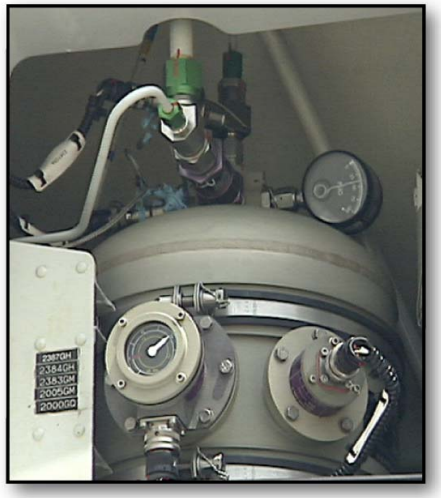
FLUID QUANTITY



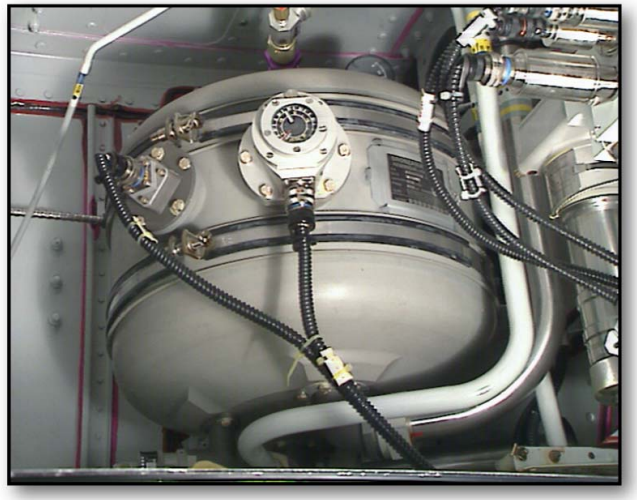
ECAM HYDRAULIC PAGE



GREEN RESERVOIR



BLUE RESERVOIR



YELLOW RESERVOIR

SERVICING - FLUID LEVEL CHECK

HYDRAULIC POWER SYSTEM LINE MAINTENANCE (2)

SERVICING (continued)

RESERVOIR FILLING

Set the yellow electric pump to ON to make sure that the brake accumulator is pressurized, then set the pump to OFF.
Connect the selected servicing source to the green servicing panel.
When you use the panel hand pump, connect the hose to the hand pump and insert it into the fluid container, and then install the pump handle. The handle is stowed at the yellow servicing panel.
When you use the external pump, connect the lower filling port and set the minimum flow (it must not be more than 435 psi).
Then select the reservoir to be filled, make sure that its related light is ON, and fill the reservoir with fluid to the upper end of the scale.

NOTE: If the reservoir is filled too much, this will cause an incorrect pressurization.

Large changes in ambient temperature can also have an effect on the reservoir level. For every 10°C change, the green and yellow volumes change by 0.50 l and the blue volume changes by 0.25 l.

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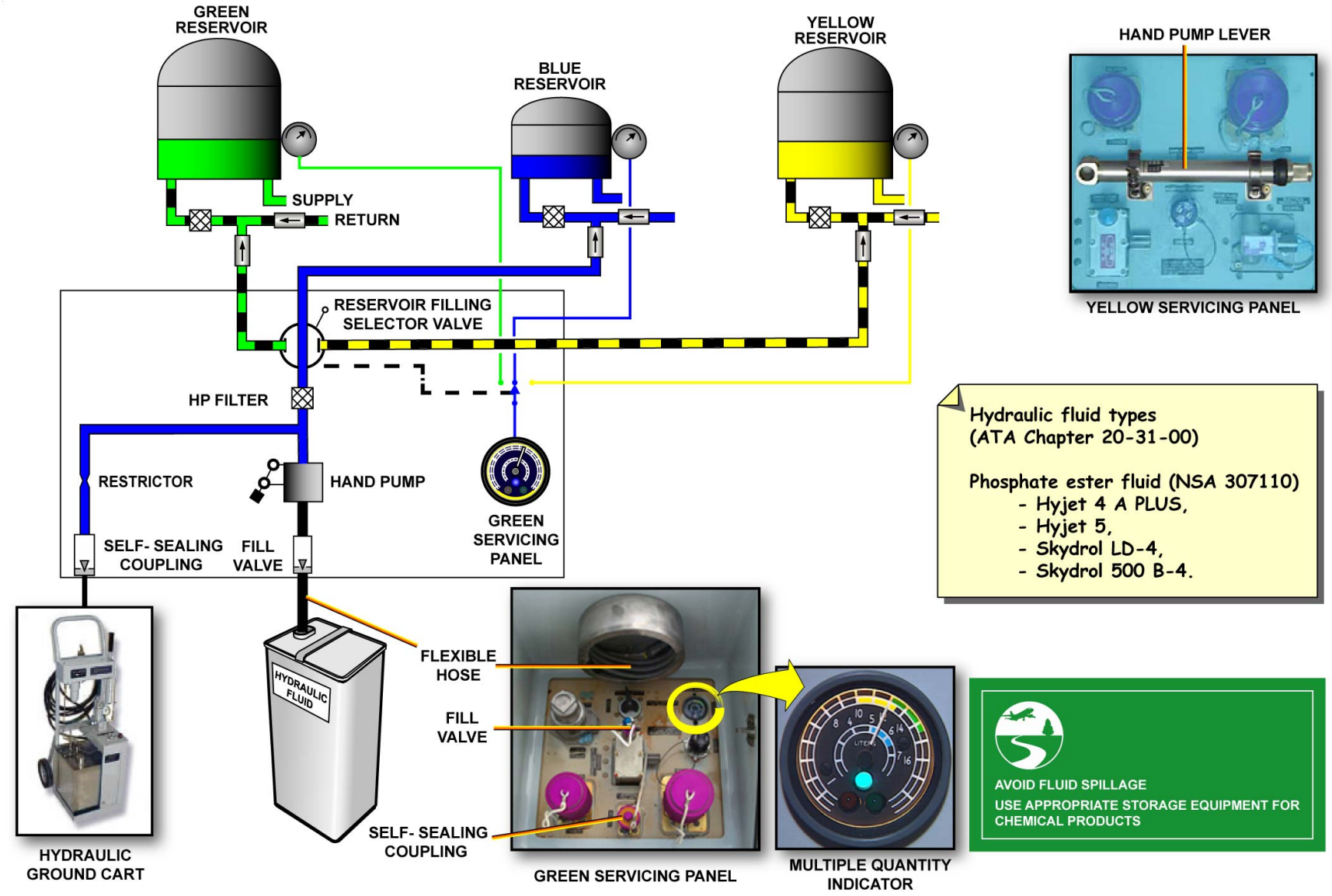

SERVICING - RESERVOIR FILLING

HYDRAULIC POWER SYSTEM LINE MAINTENANCE (2)

SERVICING (continued)

BLEEDING

If you have filled the reservoir after:
- maintenance,
- or removal/installation of large hydraulic components,
- or hydraulic fluid low level (loss of the hydraulic system),
- or high loss of hydraulic fluid,

Do the related bleeding procedure to make sure that the quantity of hydraulic fluid in the system is correct.
For instance, after maintenance of the hydraulic system upstream of the EDP.
Loosen the nut of the case drain hose so that the air (or hydraulic fluid mixed with air bubbles) comes out of the connection. Wait until the fluid flows freely and tighten the nut again.
Check for air in the system:
- make sure that the air pressure in the reservoir of the associated hydraulic system is not less than 50 psi (if necessary, pressurize the reservoir),
- read the gauge of the associated reservoir and make a note of the fluid level,
- depressurize the reservoir of the associated hydraulic system,
- after 5 minutes, read the gauge again and make a note of the level,
- compare both levels,
- if the difference between both levels is more than 2 liters, do the bleeding procedure again until the result is satisfactory.

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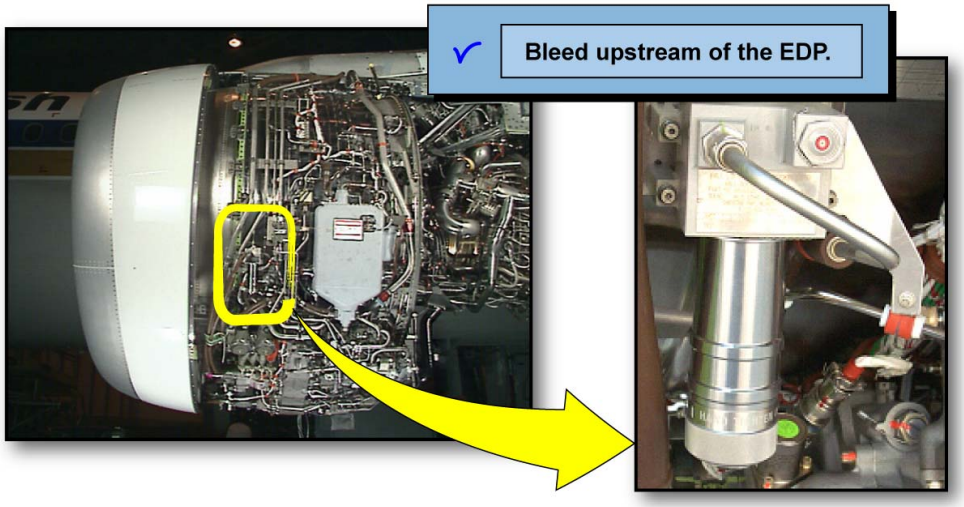


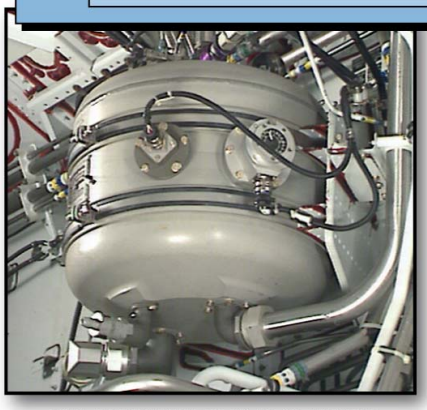
- Bleed upstream of the EDP.

EDP CASE DRAIN FILTER

- Check the pressure not to be less than 50 psi for the first fluid level check.

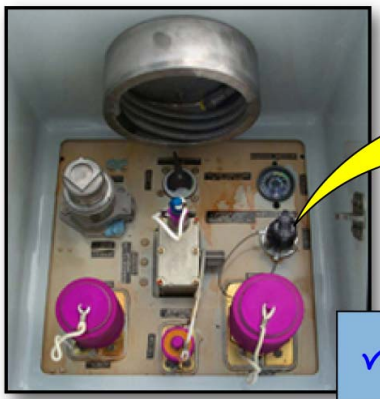
AIR PRESSURE GAGE

- Note fluid level before and after reservoir depressurization.



GREEN HYDRAULIC RESERVOIR

FLUID QUANTITY GAGE



MANUAL DEPRESSURIZATION VALVE

GREEN GROUND PANEL

- Depressurize the reservoir.

SERVICING - BLEEDING

HYDRAULIC POWER SYSTEM LINE MAINTENANCE (2)

SERVICING (continued)

HIGH PRESSURE (HP), CASE DRAIN, AND LOW PRESSURE (LP) FILTERS

The Hydraulic Systems have:
- a HP filter in the pressure line, in the reservoir filling system, and the normal and alternate braking system,
- an LP filter in the return line,
- a case drain filter in the case drain line of the EDP's and the blue electric pump.

All these filters have a red clogging indicator, which pops out when the filter is clogged (dirty) and replaceable filter elements
The LP filters have replaceable filter elements and a by-pass system.

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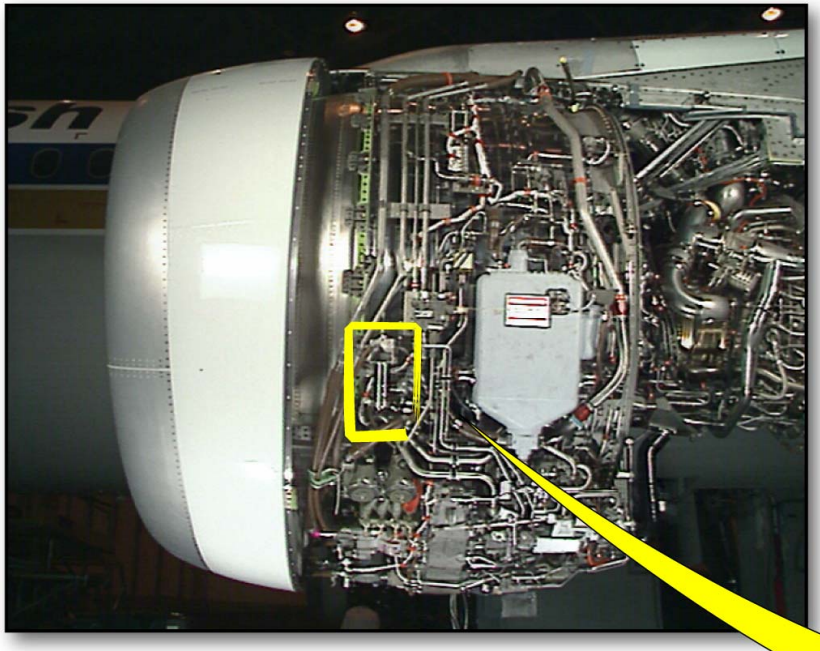
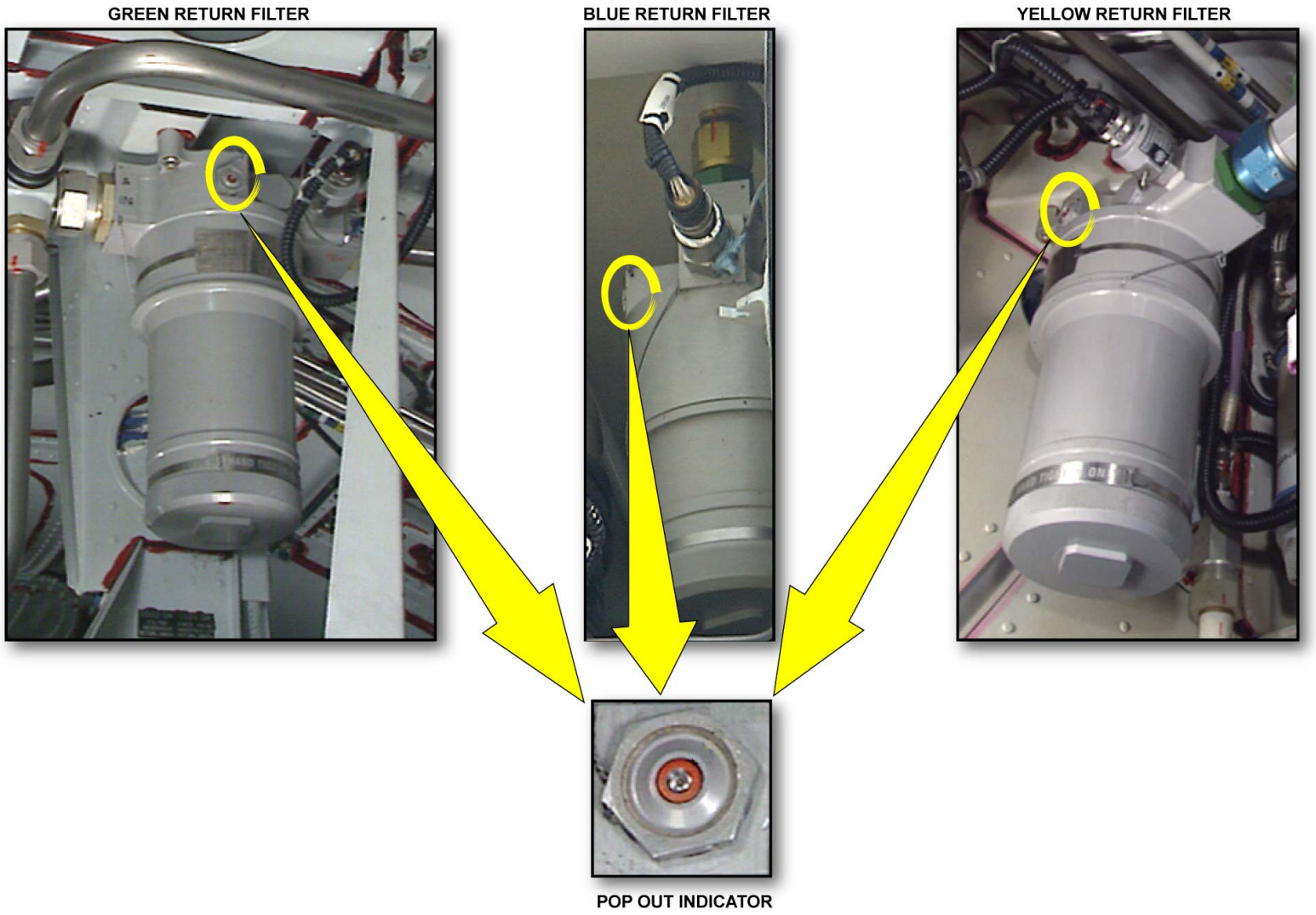


ENGINE SIDE VIEW

EDP CASE DRAIN FILTER

SERVICING - HIGH PRESSURE (HP), CASE DRAIN, AND LOW PRESSURE (LP) FILTERS



SERVICING - HIGH PRESSURE (HP), CASE DRAIN, AND LOW PRESSURE (LP) FILTERS

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HYDRAULIC POWER SYSTEM LINE MAINTENANCE (2)

SERVICING (continued)

ACCUMULATORS

Each system has an accumulator, located in its associated hydraulic bays.
The yellow brake system has an additional accumulator for emergency braking and parking brake.
The nitrogen pre-charge is adjusted at the accumulator in accordance to the ambient temperature.
On system pressurization each accumulators will take approximately 1 Lt. of fluid.
Each accumulator has a nitrogen pressure indicator.

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GREEN ACCUMULATOR

BLUE ACCUMULATOR

YELLOW ACCUMULATOR

SYSTEM ACCU

FIN: 1070 GM, 2070 GM, 3070 GM

NITROGEN PRESSURE

°C	°F	BAR	PSI
-20	- 4	108	1570
-10	+ 14	112	1620
0	+ 32	118	1710
+10	+ 50	124	1800
+20	+ 68	130	1890
+30	+ 86	136	1970
+40	+104	142	2060
+50	+122	147	2130
+60	+140	153	2220

15 D933-70162-206

CHARGING PROCEDURE REFER
TO AMM 12-14-29

SERVICING - ACCUMULATORS

HYDRAULIC POWER SYSTEM LINE MAINTENANCE (2)

SERVICING (continued)

EXTERNAL LEAK TEST OF COMPONENTS

A leak is the quantity of fluid that comes out of a component and that is sufficient to become a drop or drops, or will possibly become a drop. (approximately 20 drops =1 cc, and 75600 drops =1 gallon)
A leakage is a quantity of fluid on the surface of a component that is not sufficient to become a drop.
A stain is an area on the surface of a component that has a different color. It is usually caused when fluid leakage becomes dry on the component surface after a high temperature operation.
For a correct analysis of component leak rates, you must obey the subsequent steps:
- the seal obtained at hydraulic tube connections is obtained on metal-to-metal surfaces. If a leak cannot be stopped by tightening the nut to the specified torque, the joint is probably defective and should be repaired.
- when possible, activate components for some cycles before carrying out the external leakage check.
- dynamic seals are easy to examine for leakage while in the static condition because pistons, slide valves and swivel joints move only during a short time interval. Many components cannot be obviously monitored during operation.
- by following the AMM procedure operate the related component,
- after operation, inspect the component. If there is a sign of any external leakage, compare the quantity of leakage with the values given in the AMM table for specified limits.

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A320 HYDRAULIC SYSTEM
EXTERNAL LEAK TEST OF COMPONENTS

EQUIPMENT	NORMAL OPERATION LIMIT	DISPATCH LIMIT TO AVOID DELAY
1 HYDRAULIC PUMP Engine Driven Pump (EDP) Electric Motor Pump Ram Air Turbine (RAT) Power Transfer Unit (PTU)		
Static seals	None	2 drop per minute
Static casing	1 drop per minute	1 drop per minute
Shaft seal (system pressure)	EDP: 30 drop per min. EMP: 5 drop per min. RAT: 1 drop per min. PTU: 5 drop per min.	EDP: 60 drop per min. EMP: 30 drop per min. RAT: 1 drop per min. PTU: 30 drop per min.

SERVICING - EXTERNAL LEAK TEST OF COMPONENTS

HYDRAULIC POWER SYSTEM LINE MAINTENANCE (2)

DAILY CHECKS

During the daily check the reservoirs quantity indication on the ECAM display unit has to be checked.
In case of incorrect findings during this check, the related AMM tasks have to be done to restore the system to normal status or to readjust quantities and pressures to nominal values.
In case of hydraulic fluid level found below normal, the system needs to be refilled using the Hand Pump or a Hydraulic Service Cart.
In case of hydraulic fluid level found above normal, the system needs to be drained.

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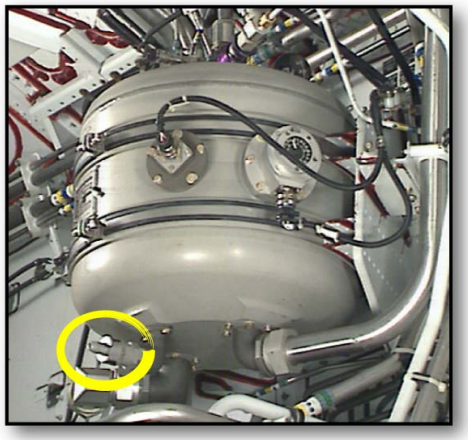
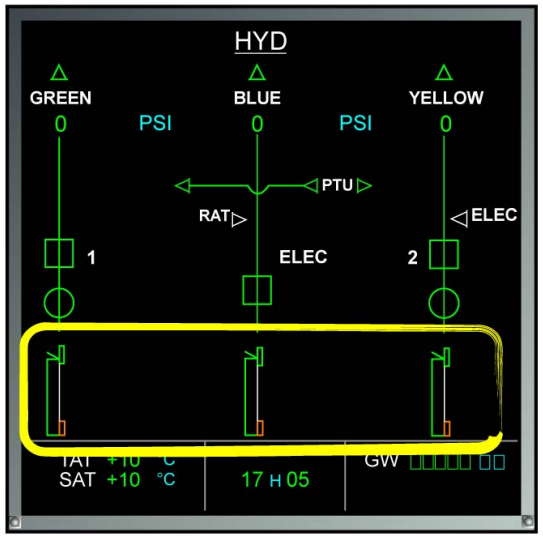


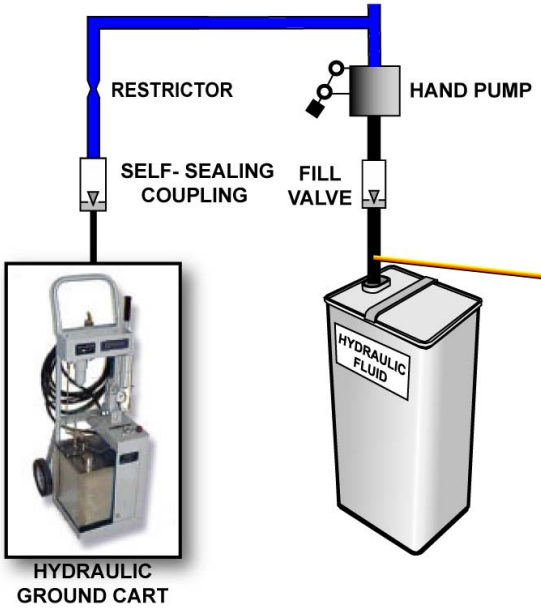
GREEN HYDRAULIC RESERVOIR

✓ Reservoir draining.

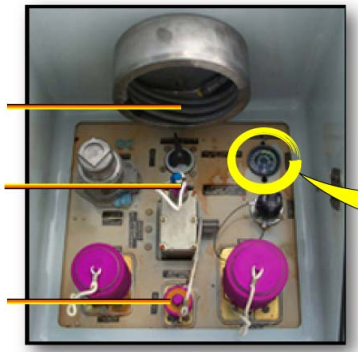
TANK DRAIN VALVE



ECAM HYDRAULIC PAGE



HYDRAULIC GROUND CART



GREEN SERVICING PANEL

✓ Reservoir filling.

MULTIPLE QUANTITY INDICATOR

DAILY CHECKS

HYDRAULIC POWER SYSTEM LINE MAINTENANCE (2)

MEL/DEACTIVATION

The fluid quantity has to be checked on the reservoir direct reading gage prior to each flight.
The LO LVL Warning has to be checked operative before the first flight.
The air pressure has to be checked on the reservoir direct reading gage prior to each flight.

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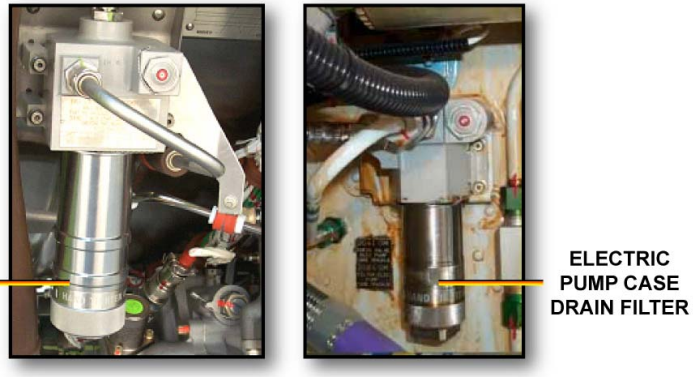
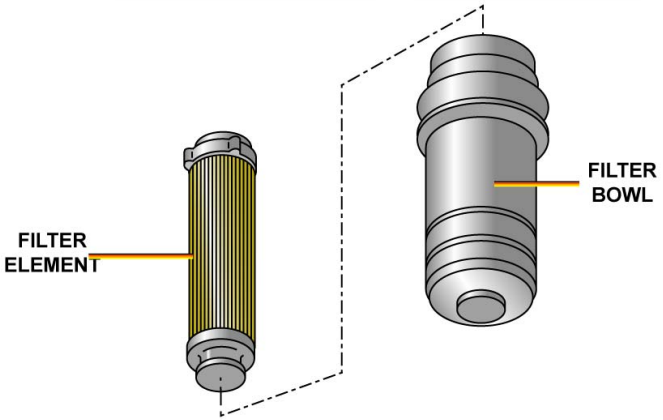
EDP and electrical pumps case drain filter de-activation:

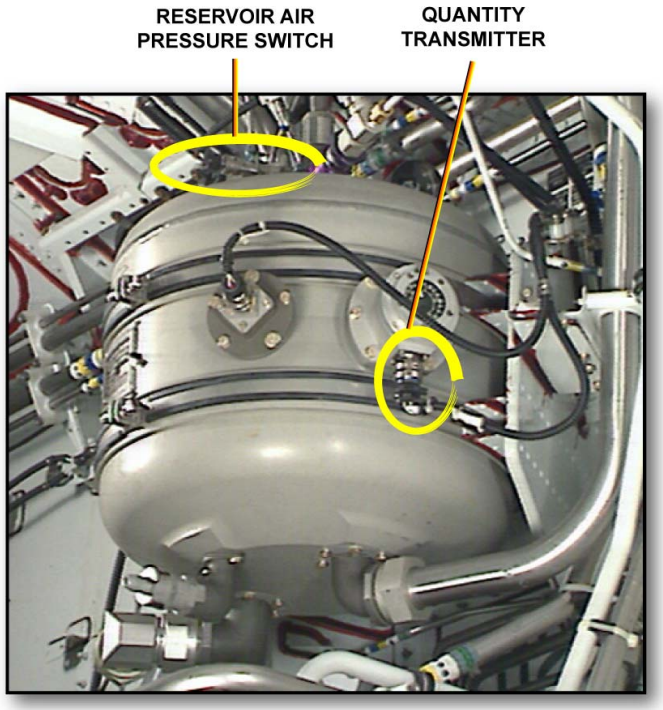
- ✓ Remove clogged filter element and reinstall filter bowl without the filter element.





Reservoir air pressure switch quantity transmitter de-activation:

- ✓ Disconnect and secure the electrical plugs.



HYDRAULIC RESERVOIR

MEL/DEACTIVATION

HYDRAULIC POWER SYSTEM LINE MAINTENANCE (2)

MAINTENANCE TIPS

PTU

PTU inhibition is achieved by closing the solenoid valves (they are fail safe open) at the PTU manifolds, and for maintenance actions by also disconnecting the coupling on the yellow (right) side of the unit. The PTU operation is inhibited at first engine start and during cargo door operation.

NOTE: At the second engine start, the inhibition is removed when the second engine master switch is set to ON then the PTU will operate momentarily for self test purpose.

RAT

A RAT retraction module controls the RAT stowage procedure. This module is installed on the blue servicing panel.

NOTE: To prevent a possible extension during maintenance work, a RAT safety tool must be installed.

SAFETY PRECAUTIONS

To prevent an unwanted operation of the PTU, the isolation coupling must be disconnected.
Keep the RAT extension area clear of ground equipment and personnel. Install the RAT safety device before working in the RAT area.

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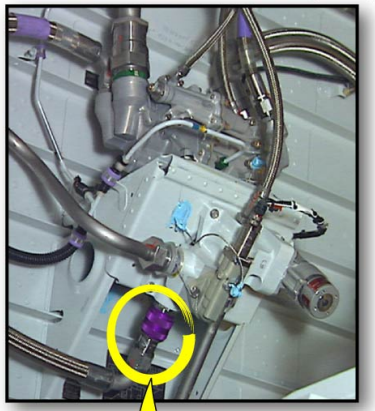
WARNING

DISCONNECT THE PTU ISOLATION COUPLING BEFORE YOU DO WORK ON THE YELLOW OR GREEN HYDRAULIC SYSTEMS TO PREVENT UNWANTED PTU OPERATION

WARNING

INSTALL THE SAFETY DEVICE BEFORE YOU DO WORK IN THE RAT AREA

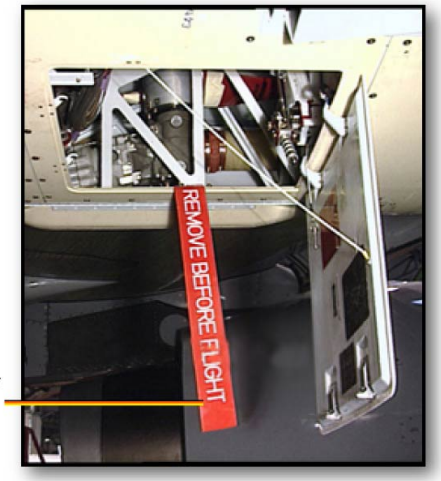
POWER TRANSFER UNIT (PTU)



PTU ISOLATION COUPLING

RAT SAFETY DEVICE

RAT EXTENDED



SAFETY FLAG

RAT IN RETRACTED POSITION

MAINTENANCE TIPS - PTU ... SAFETY PRECAUTIONS

HYDRAULIC POWER SYSTEM LINE MAINTENANCE (2)

MAINTENANCE TIPS (continued)

TIGHTENING TORQUES

Before you torque a component or connection, obey the precautions and procedures given in the tightening practices for hydraulic connection procedure in the AMM Chapter 20.
The tightening torques are given in the AMM tables chapter 20.
When you use an adapter, the values shown on the dial of the torque wrench are not the applied values .To get the correct value, the formula given on the next picture must be applied.
The drawing shows as an example the tightening torque for HARRISSON and PERMASWAGE sleeve nuts and in-line-check valves and how to use a torque wrench and adapter.

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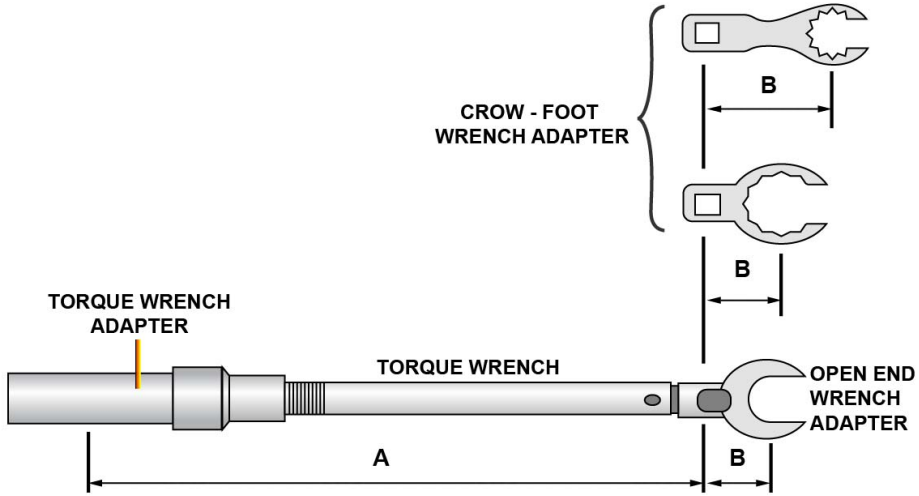
TIGHTENING TORQUES FOR HARISSON AND PERMASWAGE SLEEVE NUTS AND IN-LINE CHECK VALVES

ITEM CODE	OUTER DIA		TIGHTENING TORQUES Minimum And Maximum Values			
			CRES AND TI TUBES		ALLUMINIUM ALLOY	
	In	mm	m daN	lbf in.	m daN	lbf in.
3	3/16	4,76	1,1 1,2	97 100	1,1 1,2	1,1 1,2
4	1/4	6,35	1,5 1,7	133 150	1,2 1,3	106 115
5	5/16	7,93	2,0 2,3	177 204	1,5 1,7	133 150
6	3/8	9,52	2,9 3,2	257 283	1,8 2,0	159 177
8	1/2	12,70	5,4 5,9	478 522	3,0 3,3	266 292
10	5/8	15,87	7,5 8,3	664 735	3,9 4,3	345 380
12	3/4	19,05	9,7 10,7	859 947	4,8 5,3	425 469
16	1"	25,40	12,9 14,2	1142 1257	8,1 8,9	717 788
20	1"1/4	31,75	17,2 19,0	1522 1682	9,7 10,7	859 947
24	1"1/2	38,10	21,5 23,7	1903 2098	9,7 10,7	859 947

Note: If one of the constituents is made out of alluminum (Thread or nut). Apply the aluminum alloy values.



When you use a wrench adapter, you must adjust the torque values.
Use this formula to adjust the torque values:

$$T' = \frac{T \times A}{A + B} = \frac{2 \times 300}{300+100} = \frac{600}{400} = 1.5 \text{ m.daN}$$

T'= New torque values (adjusted) to be set on the torque wrench.
T= Specified torque value (applied on the connection).

Example:

Specified torque (T)	= 2 m.daN (177 lb.in)
Lenght of torque wrench (A) Without adapter	= 300 mm (11.8 in.)
Lenght of adapter	= 100 mm (3.9 in.)

MAINTENANCE TIPS - TIGHTENING TORQUES

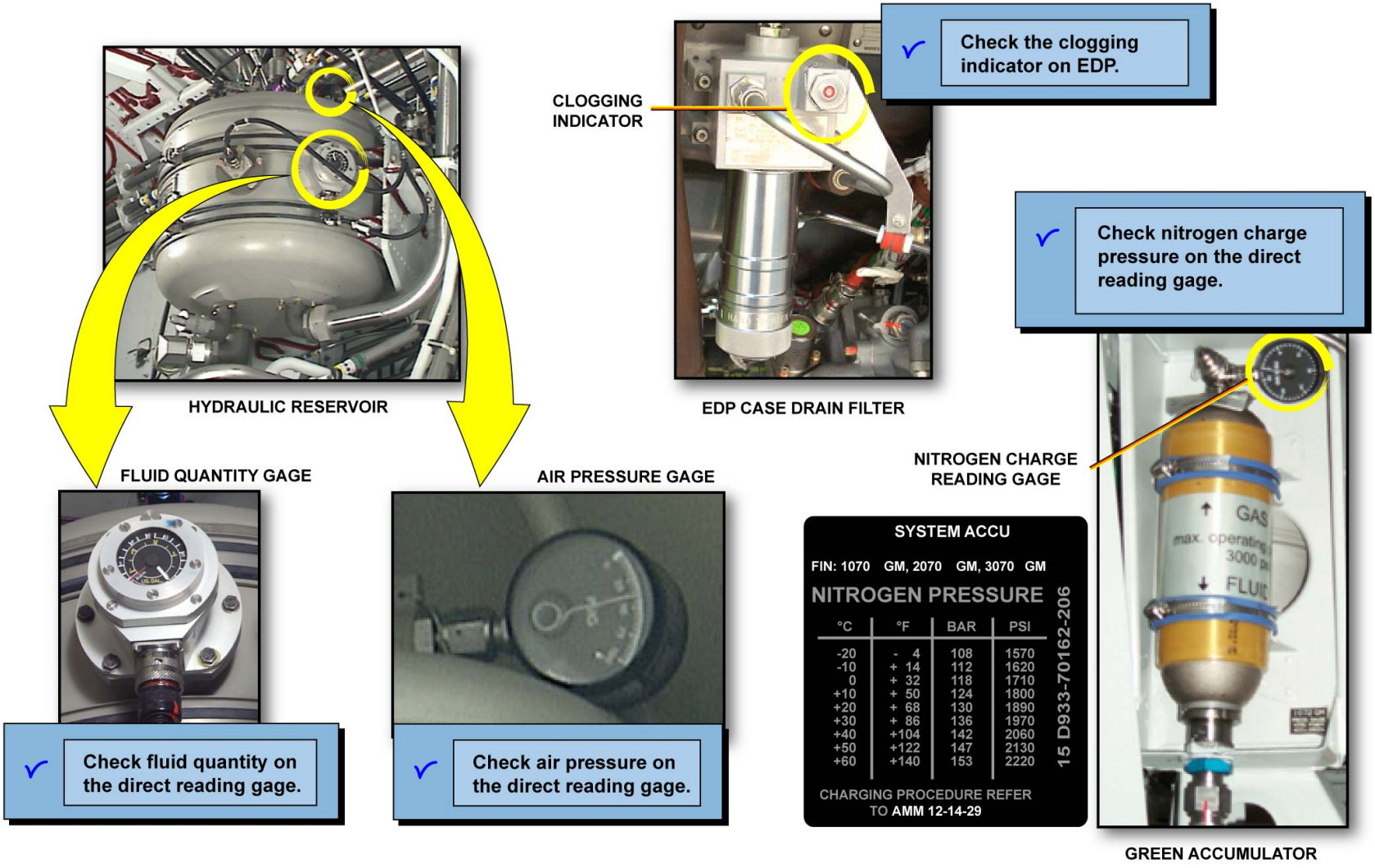
HYDRAULIC POWER SYSTEM LINE MAINTENANCE (2)

MPD CHECK ITEMS

During the scheduled check (MPD):
- the fluid level on the main hydraulic reservoir indicators has to be checked,
- the air pressure of main hydraulic power reservoir has to be checked using the reading gage,
- the clogging indicators on Engine Driven Pump (EDP) case drain filter (pop out not protruding) have to be checked,
- the nitrogen charge pressure on hydraulic power Accumulators has to be checked using the direct reading gage.

In case or incorrect findings during these checks, the related AMM tasks have to be done to restore the system to normal status or to readjust quantities and pressures to nominal values.

UGB13131 - U7ST0M0 - UM29BA000000001


HYDRAULIC RESERVOIR
CLOGGING INDICATOR
EDP CASE DRAIN FILTER
Check the clogging indicator on EDP.
Check nitrogen charge pressure on the direct reading gage.
FLUID QUANTITY GAGE
AIR PRESSURE GAGE
NITROGEN CHARGE READING GAGE
Check fluid quantity on the direct reading gage.
Check air pressure on the direct reading gage.
SYSTEM ACCU
FIN: 1070 GM, 2070 GM, 3070 GM
NITROGEN PRESSURE
°C °F BAR PSI
-20 - 4 108 1570
-10 + 14 112 1620
0 + 32 118 1710
+10 + 50 124 1800
+20 + 68 130 1890
+30 + 86 136 1970
+40 +104 142 2060
+50 +122 147 2130
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CHARGING PROCEDURE REFER TO AMM 12-14-29
GREEN ACCUMULATOR

MPD CHECK ITEMS

HYDRAULIC POWER SYSTEM LINE MAINTENANCE (2)

ENVIRONMENTAL PRECAUTIONS

Do not discharge products such as oil, fuel, solvent, lubricant either in trash bins, soil or into the water network (drains, gutters, rain water, waste water, etc...).
Sort waste fluids and use specific waste disposal containers.
Each product must be stored in an appropriate and specific cabinet or room such as a fire-resistant and sealed cupboard.

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STORE PRODUCTS IN APPROPRIATE CONTAINER/CUPBOARD/ROOM

SORT WASTE FLUIDS IN CONTAINERS

AVOID FLUID SPILLAGE
USE APPROPRIATE STORAGE EQUIPMENT FOR CHEMICAL PRODUCTS

FLUID SPILL CLEANUP KIT

USE SPECIFIC WASTE DISPOSAL CONTAINERS

ENVIRONMENTAL PRECAUTIONS

RAT TEST (3)

PRECAUTIONS

WARNING: PUT THE SAFETY DEVICES AND THE WARNING NOTICES IN POSITION BEFORE YOU START A TASK ON OR NEAR:
- THE FLIGHT CONTROLS,
- THE FLIGHT CONTROL SURFACES,
- THE L/G AND THE RELATED DOORS,
- COMPONENTS THAT MOVE.

MAKE SURE THAT THE TRAVEL RANGES OF THE FLIGHT CONTROL SURFACES ARE CLEAR BEFORE YOU PRESSURIZE/DEPRESSURIZE A HYDRAULIC SYSTEM.
MAKE SURE THAT THE SAFETY LOCKS ARE IN POSITION ON THE L/G.
MAKE SURE THAT THE RAM AIR TURBINE (RAT) TRAVEL RANGE IS CLEAR BEFORE YOU EXTEND THE RAT.
PLACE SAFETY BARRIERS IN POSITION AND FIT THE RAT PROTECTIVE EQUIPMENT AS PER AMM PROCEDURE.
DO NOT STAND IN FRONT OF OR BESIDE THE RAT PROPELLER ASSEMBLY DURING THE FUNCTIONAL TEST.

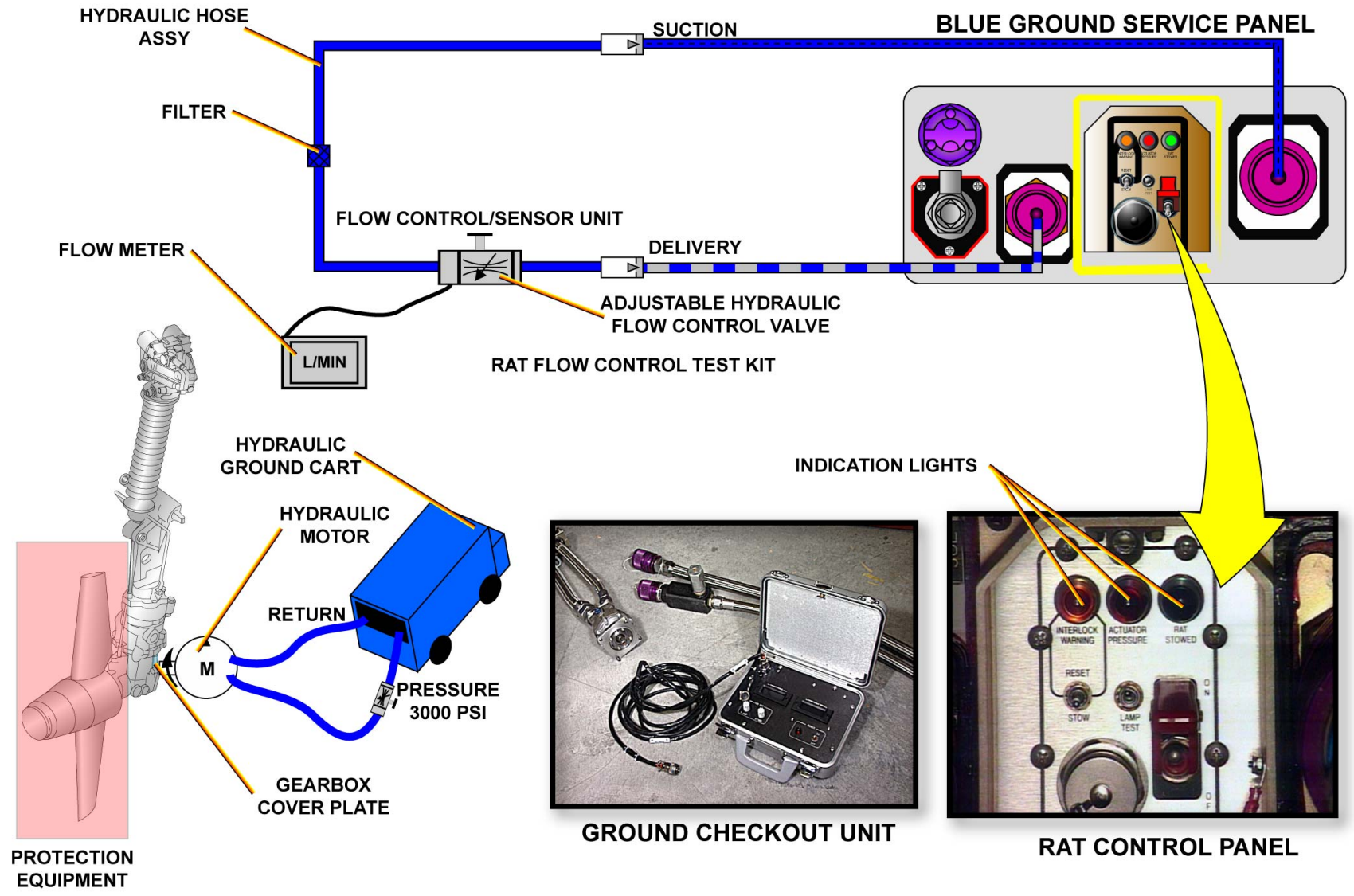
NOTE: Note: do not operate the RAT deployment solenoids for more than 60 sec. You can operate them more than once, but you must then let them cool down for 30 min.

CAUTION: MAKE SURE THAT YOU INSTALL THE PROTECTIVE EQUIPMENT CORRECTLY, THAT IT IS STABLE AND THAT IT CANNOT MOVE DURING THE TEST.
IF THE PROTECTIVE EQUIPMENT MOVES DURING THE TEST, IT CAN TOUCH THE RAT AND CAUSE DAMAGE.

MAIN STEPS OF THE TEST OPERATION

PREPARATION OF RAT TEST

To functionally check the RAT on ground it is necessary to:
- manually deploy the RAT from the cockpit,
- connect the ground test motor to the RAT gearbox,
- connect the ground checkout unit to the RAT control panel,
- connect the RAT flow control test kit to the blue ground service panel.



PRECAUTIONS & MAIN STEPS OF THE TEST OPERATION

RAT TEST (3)

MAIN STEPS OF THE TEST OPERATION (continued)

RAT EXTENSION

Before you start with the extension you need to gain access to the blue hydraulic compartment to remove the RAT Safety tool.
Warning: Make sure the travel range of the RAT is clear and the area secured before you start with the extension.
In the cockpit, make sure that all related circuit breakers are closed.
Push the RAT MAN On pushbutton on the Emergency Electrical Panel to extend the RAT.
To retract the RAT, you need to start the blue electric pump on the maintenance panel by pressing the Blue Pump Override push button.
Check on the hydraulic page of the system display that the pressure in the blue system is correct and the RAT symbol is shown in green.
Open and safety the CB on the rear circuit breaker panel.
Gain access to the Blue Ground Service panel and open the RAT Stow Panel.
Operate the lights test switch to check the condition of the indicator lights. Lift the guard of the master switch and select it to "on". Set the Stow/Reset switch to the reset position before selecting it to the stow position. The red indicator light comes on to show that the retraction actuator is now pressurized and the RAT retracts.
If the amber Interlock light comes on, the retraction is stopped because the blades are not correctly aligned. Align the blades and reset the Interlock caution light.
Hold the stow switch in the stow position. The red light comes on to show the retraction actuator is pressurized. Hold the stow switch until the RAT is completely retracted and the green "stowed" light comes on.
Close the stow panel access door and the blue ground service panel.
In the cockpit select the Blue Pump Override pushbutton to 'off' and check on the hydraulic page that the pressure reads zero and the RAT symbol is shown in white.
To install the RAT safety tool you need to adjust the length and the gap between the tool and the RAT.
Make sure there is no contact between the tool and the RAT and there is a gap of minimum 1 millimeter.

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MAIN STEPS OF THE TEST OPERATION - RAT EXTENSION

RAT TEST (3)

MAIN STEPS OF THE TEST OPERATION (continued)

RAT TEST

Before starting the test, all relevant circuit breakers must be closed, and the RAT travel range and the area must be secured
Extend the RAT by pressing the RAT MAN ON pushbutton on the hydraulics control panel.
Check on the hydraulic page that the RAT symbol is shown in green in association with a single chime "RAT Fault" message on ECAM.
Retract the RAT via the blue hydraulic ground service panel following the same procedure as for the RAT Extension Test.
Extend the RAT again by pressing the RAT Man ON pushbutton on the Emergency Electrical panel. Check again the indication on the hydraulic page to show the RAT symbol in green in association with a single chime "RAT Fault" message on ECAM.
Open and safety the relevant CB depending on the task.
Examine the RAT for damages and check the oil level of the gearbox and make sure there are no leaks.
Remove the cover plate on the rear to prepare the installation of the hydraulic drive motor. Align the spine-shaft and tighten the attachment bolts.
Connect the pressure and suction hose of the hydraulic ground cart to the blue ground service panel. Make sure you rotate the nut to the very end of the thread to make sure the self-sealing coupling is open.
Open the stow-panel access to connect the electrical cable of the ground test box to the connector on the stow-panel.
Install the safety device inside the RAT bay that will hold the test cage in position during the test.
Place the test cage in position and align the hydraulic lines and the cage to be in the correct position for the forward safety strut to engage on the cage fitting.
Press the Blue Leak Measurement pushbutton to isolate the primary flights controls from the hydraulic supply. Start the Blue Electric Pump via the override pushbutton on the maintenance panel. Check the hydraulic pressure on the hydraulic system page and make sure the RAT does not start rotating when the system is fully pressurized.
On the ground test equipment, open the supply to the motor to drive the blades. Check that the flow created by the pump is in accordance with the figures given in the table. Simulate different load conditions with the by-pass according to the task.
Stop the blue electrical pump from pressurizing the blue system and select the blue leak measurement valve to the open position.
Check on the hydraulic page that the system is completely depressurized.
Remove the test cage and examine the RAT for damage and leaks.
Remove the hydraulic drive motor from the rear of the RAT and reinstall the cover and
re-stow the RAT.

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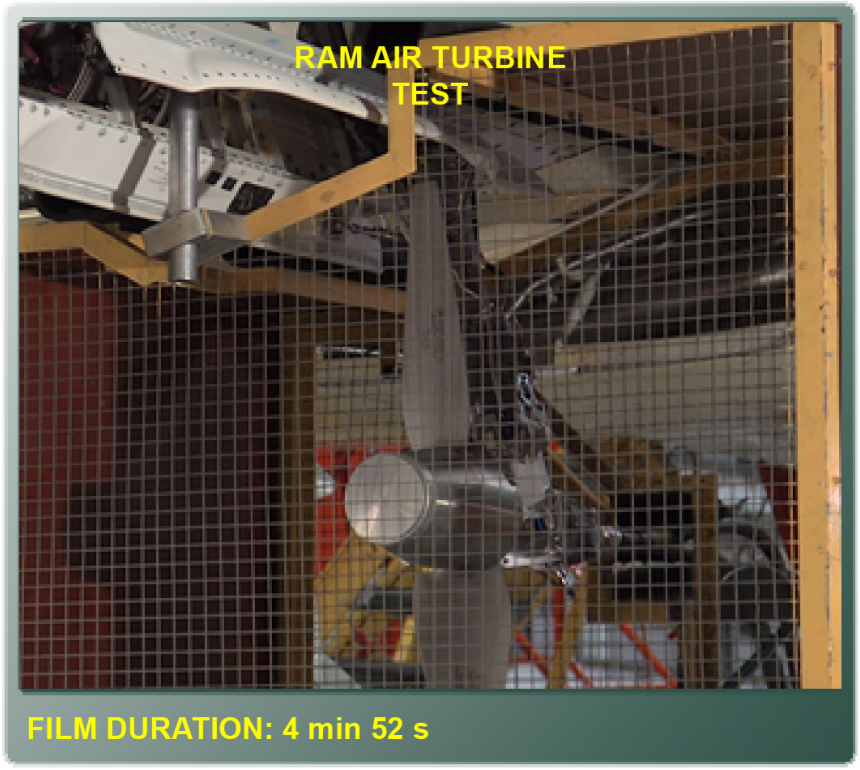

MAIN STEPS OF THE TEST OPERATION - RAT TEST

HYDRAULIC LEAKAGE (3)

warning

WARNING: PROTECT YOUR HANDS AND FACE FROM THE HYDRAULIC FLUID WHICH COMES OUT WHEN YOU UNSCREW HYDRAULIC LINES AND COMPONENTS. HYDRAULIC FLUID ITSELF IS A CONTAMINANT. USE APPROPRIATE SAFETY WEAR.

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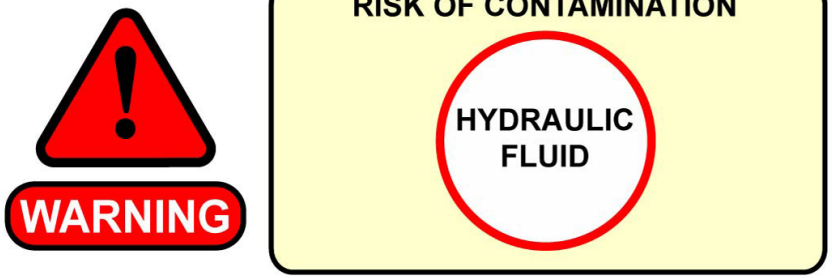
WARNING
RISK OF CONTAMINATION
HYDRAULIC FLUID

USE APPROPRIATE SAFETY WEAR

WARNING

HYDRAULIC LEAKAGE (3)

Preventing Hydraulic Leaks

These simple plumbing problems can also be real hard to fix if you don't know the basic hydraulic plumbing rules. If you don't work carefully and follow these rules, your work may be the cause of the next hydraulic leak that delays or cancels a flight. Let's look at these basic hydraulic plumbing rules: contamination that gets into a system or collects on sealing surfaces can cause leaks internal and external. Hydraulic fluid itself is a contaminant. It can eat paint and decals. When hydraulic fluid is allowed to penetrate a composite structure, it will attack the core material and reduce it to mush. Once a composite assembly has been attacked, its structural integrity will be lost. To avoid damage caused by twisting, tearing, and chipping, always lubricate O-rings, packing seals, back-up rings, and fitting threads with hydraulic fluid before assembly. When assembling hydraulic system fittings, be sure that seals and back-up rings are properly positioned before torquing the connection. When installing an elbow fitting into a component, be sure that all the threads are completely screwed into the boss. This is to make sure that the O-ring packing rides in the undercut, and not on the threads. To prevent an elbow fitting from turning while its lock-nut is being torqued, hold it with a second wrench.

To make a stress-free installation, be sure that all elbow-to-pipe connections are correctly aligned before torquing the B-nuts. Do not use pointed, sharp-edged, or steel tools to remove or install O-ring packing, back-up rings, and seals. Damage may occur. Never reinstall used O-ring packing or seals. Once they have been compressed, they will never regain their original shape again. Before torquing a B-nut, be sure that the tube fits squarely into the fitting. Never force or bend a tube to make it fit. Metal tubes don't stretch. If the piece seems shorter upon reinstallation or after a component change, something is wrong. Stop! Think! And investigate the problem before you proceed. Make sure that tubes are not forced into clamps or line blocks. A stressed installation will lead to a cracked tube at the nearest fitting or B-nut. And, you can bet it won't be long before it happens. If clamps or line blocks are removed so a tube or component can be replaced, be sure that they are reinstalled again. Tubes that are not properly supported will vibrate. Vibration is the greatest enemy of a hydraulic system. It causes tubes to crack, and connections at fittings to loosen up and leak. When repairs are finished, always bleed the system, and leak check your work. We, the mechanics, have control of torquing. The lack of proper torquing is the single greatest cause of leaks. Those calibrated elbows are notorious for being out of calibration. Use a torque wrench.

PREVENTING HYDRAULIC LEAKS

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